Chrome Ore, source of chromium, is important among the mineral resources of modern Turkey. Discovered in 1848 by J. Lawrence Smith, an American, the history of its exploitation was indefinite until the rise of the present Government. Under the vigorous action of the Republican régime, production has grown from practically nothing in 1923 to over 200,000 tons in 1938, as is set forth briefly in the summary article on pages 34-35 of this issue. A comprehensive description of Turkey's chrome mining industry will be presented in the June number. The author will be Enoch Perkins, of the Mutual Chemical Company of America, representatives of the Turkish Government in this country with respect to chrome.

▼

Gold Ore treatment in the Dominion of Canada is by no means static. Certain present trends and the progress made will be discussed next month by Henry Hanson, who will seek to interpret why certain changes have been brought about.

▼

Found, last October, in Brazil, a blue-white diamond weighing 726.6 metric carats. Known as the "President Vargas," it is third in size among the world's diamonds, the other two being the Cullinan (3024.75 carats) and the Excelsior (971.75). It is 71 mm. long, 56.5 wide, and 24.5 high and is valued uncut at 750,000 florins in Amsterdam, where it rests. In contrast is the garnet exceeding 20 in. in diameter, one of the world's largest, that is now on display at Columbia's geology museum. It is of the type that is used, when ground, for making "sand" paper and that sells at $75 a ton, approximately, in the prepared state.

▼

Arizona celebrates its Cuatro Centennial in 1939, the year marking the end of the first four centuries of the white man's history in this part of the Southwest. Copper pasters affixed to mail are being employed to make the occasion known. San Francisco's Engineering Council has named July 13 as Engineer's Day at the Golden Gate Exposition. And, lest we forget, 1939 marks the fiftieth anniversary of the first successful commercial application of cyanidation, as yet uncelebrated.

Metal Shot, so fine it will float on water, makes it possible to take sharply outlined X-ray photographs of irregular objects (for example a monkey wrench) instead of the blurred-edge pictures usually obtained. The shot, which is poured over and around the object, blocking it out, is produced in the General Electric laboratory by a special process.

Steel Sections, cold-formed, for prefabricated building units for houses and other structures, are now to be made on a quantity basis by Tennessee Coal, Iron & Railroad Company at Birmingham, Ala. The work done in this field some months ago, when units of farm buildings were sold to the Farm Security Administration, has led to increased orders.

H. C. PARMELEE
Editorial Director

Engineering and Mining Journal

A. W. FISHER
Manager

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Vice-President

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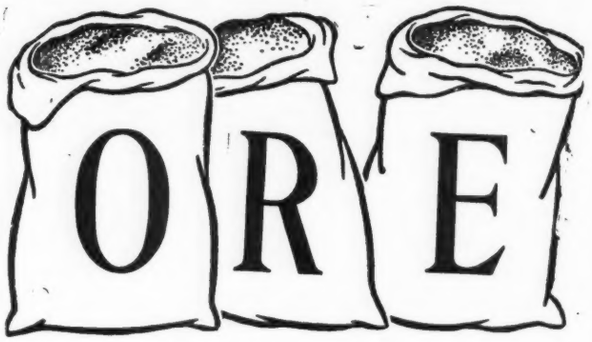

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Volume 140 Number 5

MAY, 1939

The Burden of Taxation

MORE AND MORE, taxation takes on the aspect of a continuing raid on industry. On the one hand, producers are seen striving to lower costs, to the end that their enterprises may be profitable and that it may be possible to continue them. And technical skill is directed to bringing new employment-giving ventures to success. On the other hand, an ever-growing share of the winnings of the producers is exacted to meet Government expenses. The steady growth of this burden of taxation is cause for serious thought. So far as operations in the United States are concerned, it is of course illogical, under an economic system based on private ownership and supposedly actuated by the profit motive, to destroy profits thus or to reduce them to the point where the risk outweighs the gain. Yet the trend here as elsewhere is in this direction.

The answer is not hard to see. Unless the trend be checked, mining will become less attractive to capital, production will fall, new enterprises will be fewer, and the revenue derived from the industry by Government will decrease. It will not be the first time that an industry has been taxed into a decline or that Government has overplayed its hand.

Company reports offer evidence of the tax burden on the mining industry. To take a company of moderate size, the report of the Hecla Mining Company, in Idaho, with 465 employees in 1938, reveals a levy for all purposes that amounted to approximately 19 per cent of the profits, to over 45 per cent of the dividends, and to $266 per man employed. For the Polaris, a subsidiary working only 113 men, the taxes were almost 21 per cent of profits, over 36 per cent of dividends, and $706 per employee.

For a larger company and one conducting many diverse mining and metallurgical operations in the United States and abroad, one may choose the American Smelting & Refining Company. The report of this enterprise for 1938 tabulates the taxes paid directly for six separate years. From $600,000 paid in 1913, on a net income (before taxes) of $10,400,000, the total leaped to $4,700,000 in 1926 on a net income of $22,500,000; to $6,000,000 tax in 1936 on $23,100,000 income; and to $8,200,000 in 1937 on $26,500,000 income. In 1938 the tax fell to $6,600,000, but for the much smaller income of $17,200,000, thereby making an interesting comparison with the figures for 1936.

The star exhibit of burdensome taxation that the United States mining industry has to offer is that levied on the mines of the Minnesota iron ranges, where ore reserves are taxed annually in the ground. The situation there has seen its great development, in point of revenue exacted, since the end of the World War. The total State and local taxes, plus the lesser but still material "occupation" and royalty taxes (which the producer also pays), have varied from 46.5 cents per ton of ore shipped in 1929, when 47,478,000 tons was sent to the Lower Lake ports, to $7.348 per ton shipped in 1932, when only 2,250,000 tons was shipped. Here is demonstrated the working of the plan, whereby unmined reserves are taxed instead of profits or production. In 1937, the record year for shipments from the State, the tax was 56.3 cents per ton shipped, on a total shipment of 49,052,000 tons.

American companies abroad do not escape the tax gatherer, as may be inferred from the already cited American Smelting report, in which, however, it is not possible to discern the proportion of the total tax paid on the company's foreign operations. Rising taxation seems to be a world-wide epidemic. The burden borne by one large company, operating wholly in Mexico, was cited in an earlier issue (February 1939) as typical of the situation in that country. No less than 38 per cent of its total outlay for six months of 1938 was chargeable to taxation, the total exceeding the amount expended for wages, salaries, and other money paid to labor.

Chile has been casting wishful eyes of late upon its copper industry, as set forth in the news in recent issues. An increase in revenue from this source would be welcome to its Government for various reasons. The nitrate business has long since declined, the Government's social-improvement program requires money, and, to cap the climax, the disastrous earthquake of a short time ago makes new expenditures imperative. A 10 per cent tax on producers' profits is contemplated, this in addition to existing taxes. As the Kennecott report remarks, with reference to Braden Copper, these plans, though indefinite as yet, will inevitably

result in a greater burden on the company.

Thus goes the trend of mine taxation—almost always upward, rarely down. The natural-resource industries are in a more vulnerable position than other industries, doubtless because the same concepts as those on which crown rights to mineral in the ground were based for centuries in many countries, exist also in the popular mind. This mind, however, has scarcely any idea at all of the investment required to make a mine and of the risks to which that investment is subject.

Barter for Tin

THE PROPOSAL IS MADE that the United States enter into a treaty covering a barter agreement with Great Britain and the Netherlands, to the end that some of this country's surplus cotton and wheat may be exchanged for tin and rubber wherewith to build up military reserves of these commodities (see page 68, this issue).

The new scheme has its merits. It is one way of getting the desired tin, at least, without putting up the money for it, and at the same time getting rid of some unwanted wheat or cotton. Just how the details of exchange would be arranged does not immediately appear, but no doubt they could be worked out. The existence of a treaty agreement would moreover serve to guarantee that the reserve would not suddenly be released for sale, should a new Congress be so inclined, although it could not do away with the weakening effect that the reserve supply would have upon the market as the expiration date of the five-year period of impounding drew near. And if the proposal be confined to tin (to say nothing of the rubber), there will be no howl from domestic producers of the metal, inasmuch as there are none—as yet. Despite all this, the idea of the nation holding the world's largest stock of gold entering upon a course of bartering is rather startling.

A Boost for White Lead

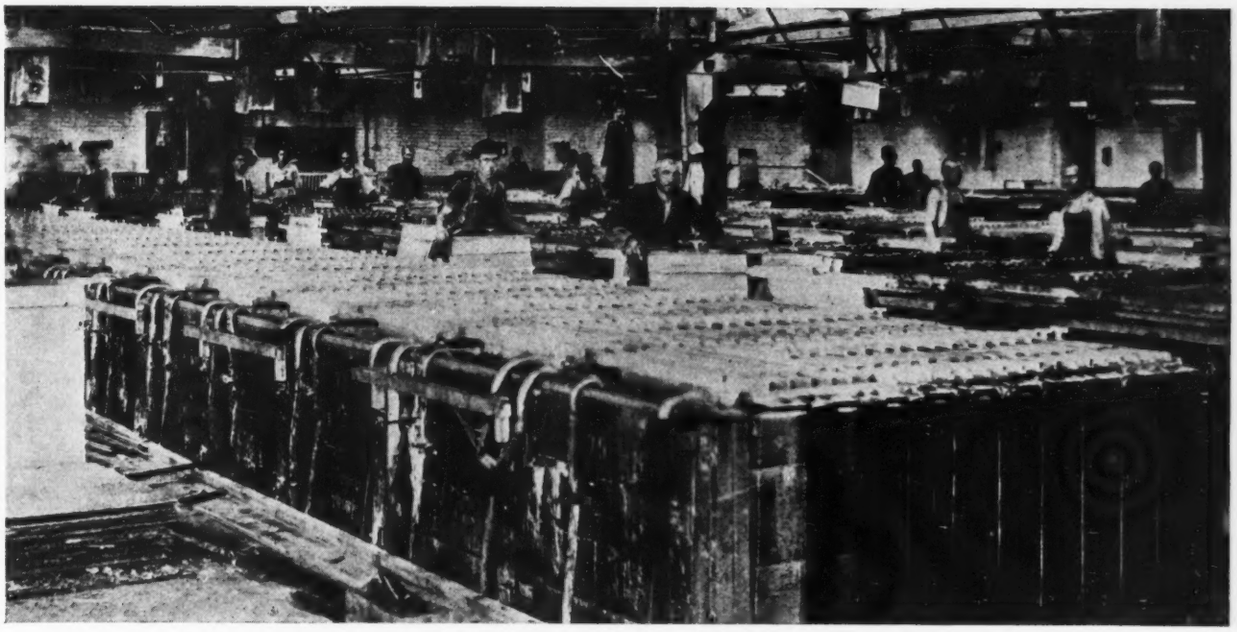
LEAD is a long-lived metal. It was known in ancient times, and no doubt some of it that once served the Pharaohs is still in use. Bearing witness of its lasting qualities is the large amount of lead scrap in circulation. As in the case of certain other metals, this longevity of lead, though gratifying on various counts, is not always a cause of joy to the producers, who would scarcely be human if they did not wish occasionally that the metal sold would never come again upon the market. Such aspirations are realized, in part, in the case of lead that goes into pigment manufacture.

Pigments afford an important outlet for the metal. In 1937, the latest year for which figures are available, 133,000 short tons of lead was consumed in the United States, in the form of white lead, red lead, and litharge, according to the estimates of the American Bureau of Metal Statistics, this exclusive of the quantities of red lead and litharge used in storage batteries. Thus an important part of the total lead output of the country during that year was disposed of in such a way that it can be counted upon never to reappear for sale. Of the white lead in particular, representing 86,000 tons of metal in 1937, approximately 95 per cent is manufactured into paint, the remainder being used in ceramics and in miscellaneous ways. An outlet so welcome should logically be expanded.

A campaign to this end, in behalf of white lead, has recently been launched by the Lead Industries Association. It is to continue for three years, by the end of which time, the country, it is hoped, will be well aware of the qualities of this pigment for refurbishing plant and dwelling and the buildings on the farm. America can use a lot of paint, as many a dingy looking structure testifies.

America's Achievement

SEVERAL EXHIBITS bring the story of the American mining industry and its achievements to the public at the New York World's Fair. Congratulations are due the steel companies of the country, the Copper and Brass Research Association, and Anthracite Industries, Inc., for their striking displays and their enterprise in seizing so excellent an opportunity for telling visitors from all parts of the nation, as well as from abroad, about the important place occupied by their respective enterprises in this country's economic and social structure. Here was the ideal moment longed for by every public relations counsel. It is regrettable that more individual companies and groups engaged in mining have not seen fit to turn it to advantage. The central theme of the Fair may be the World of Tomorrow but, in the splendid efforts made to depict the time that is to come, it is the World of Today that is revealed in all its magnificent material accomplishment. In this day of unrest, when dissatisfaction is so freely expressed with present difficulties, caused indeed by the rapid development of industry, the public should not be permitted to lose sight of the fact that this great national growth has been achieved under the institution of private ownership and free competition.



The cell room for zinc electrolysis at the Ordzhonikidze plant

Producing Electrolytic Zinc In the Soviet Union

Two plants, with a total annual capacity of 40,000 tons of metal, have been working for several years

Julius H. Gillis
Metallurgical Engineer
Sylva, N. C.

▶ AFTER *spending seven years in the Soviet Union, where he was associated with the developments that he discusses here, Mr. Gillis returned to the United States in the latter part of 1937. He confines himself in this article to discussing certain points of interest in connection with the new plants at Ordzhonikidze and Chelyabinsk, the first employing the electrolytic process to be installed by the Soviet. He points out that what was done may not have been the best practice, but it was the best that could be done under the existing circumstances.*

ZINC PRODUCTION of the Soviet Union is based on five plants, of which three are distillation and two are electrolytic plants. Only one of these plants was in operation before the beginning of the present reconstruction period. This was a small zinc distillation plant operated in connection with the old lead-zinc-silver mines situated in the North Caucasus. These are old workings and were operated by French, Belgian, and British interests before the revolution. The distillation department of the plant has at present a production capacity of about 3,500 tons per year.

The other two distillation plants were built as part of the first five-year plan and were placed in operation in 1930 and 1931. One is at Kanstantinovka, in the Ukraine, where fuel is of good quality and plentiful, and is convenient to the Black Sea ports. It was intended that the principal supply for it would be concentrates from certain Far Eastern mines, which were transported as ballast in ships returning empty by way of the Suez Canal from the Far East, so that, theoretically at least, the transportation cost would be very low. The plant is also conveniently situated for treatment of concentrates from the North Caucasus or other points in the Soviet Union. The other distillation plant is at Belova, in the Kuznetsk coal district, in central Siberia, not far from the Salersky mines and also convenient to the Altai district. It was put into operation in 1931.

Both of these distillation plants have a capacity of about 12,500 tons of slab zinc per year and have operated at times at somewhat above that capacity. They have now been running for several years, and when the supply of concentrates was ample have demonstrated the ability of the Russian workers and engineers to produce zinc by this rather difficult method. During the periods of construction and early operation they had some German technical assistance, but in the last few years have been run entirely by Soviet workmen.

My primary purpose, however, is to touch on some of the matters connected with the establishment of the electrolytic zinc industry in the Soviet Union. As long ago as 1928, a pilot plant was built at the works of the lead works at Ridder, in the Altai, and designs were made for an electrolytic zinc plant at that point, and for plants at Kemeroy, Chelyabinsk, and Vladikavkas (since changed to Ordzhonikidze). The pilot plant and the projected plants were all designed to follow strictly the low-density, double-leach system used at Anaconda and Trail. The principal objection to these plans, and, I might say also, to those of many other plants in the Soviet Union, was that they were all

designed for a flat site. This makes some of the material-handling problems very difficult and in most metallurgical operations material handling is the dominating feature. Unfortunately, these errors were only partly corrected in redesigning the plants, leaving unnecessary complications and necessitating extra equipment in interdepartment communications. In 1930, at the time of the great trek of American engineers to the Soviet Union, these difficulties in connection with many others were the subject of many conferences and much discussion, all of which finally led to changing the designs and constructing two plants, each with a capacity of 20,000 tons of electrolytic slab zinc per year.

Except for conforming to local conditions, these plants were of almost identical construction. One, the first to be completed, was built at the city of Ordzhonikidze, in the North Caucasus, as a department of the old lead-zinc smelter at that point, which was supplied mostly from the Sadon mine and Mezursky concentrator, about 80 miles distant. The other electrolytic plant was constructed at Chelyabinsk, on the east slope of the Urals, and was intended to treat concentrates from the copper-zinc ores of the Urals. Construction work for it was started at the same time as the Ordzhonikidze plant, but the latter was given preference in regard to materials and appropriations and was completed about fifteen months earlier, the first cathodes being produced Jan. 3, 1934. The Chelyabinsk plant produced the first cathodes April 6, 1935. Both plants, in addition to handling the local concentrates, expected to and did treat concentrates from the Ridder mines.

Departures From Practice Elsewhere

In redesigning these plants several departures were made from the practice current at Great Falls and Trail, as will be noted.

Concentrates were normally received from the concentrators in either flat cars with side boards about a foot high or in box cars. These cars were the standard two-axle type common on Russian as well as most European railroads. The capacity was from 16 to 20 tons. Occasionally an "Americansky" type of car would come in, which meant a four-axle car with swivelled trucks, of about 40 tons' capacity. There were a few of them scattered throughout the Soviet Union. Owing to the congestion on the railroads the rules regarding demurrage were strictly inforced, especially at Chelyabinsk. At first we had eight hours to bring the cars in from the switch about 5 km. distance, unload them, and get the cars back to the switch. Later this time was cut to 3½ hours, but we seldom had any demurrage even though we would get a string of 40 cars in the middle of the night and frozen solid. It is such regulations as the restriction just mentioned which help to make necessary the excessive number of employees around plants in the Soviet Union.

At both plants cars were unloaded by hand into a storage shed, whence the contents were taken by belt conveyors to the storage bins and roasters. The Chelyabinsk plant, being in very cold climate, was provided with a thaw house at the unloading racks, but owing to the demurrage regulations that feature never was used. Both plants had had a disintegrator installed over the conveyor belt so that any caked concentrates as well as the return lumps for the roaster could be broken up or bypassed as desired.

Six standard Type 7 roasters having hearths of 25-ft. diameter were provided at each plant and two extra roasters were provided at Chelyabinsk to give extra roasting capacity for a lithopone plant which was under construction, but not completed, while I was there. Both plants were designed to deliver gases to a stack or an acid plant as desired. At Ordzhonikidze the acid plant was placed in operation at the same time as the zinc plant, but at Chelyabinsk the acid plant was not completed at the time I left in 1937. A 50-ton storage bin was provided over each furnace with a standard steel-plate feeder which dropped the concentrates on the dryer hearth near the periphery.

The top hearth of the roasters was constructed of steel and used as a dryer hearth. This was satisfactory from a metallurgical standpoint and not only improved the roasting, but saved fuel, and by giving a more completed drying on this hearth, kept moisture out of the gases. However, owing to the way they were built, being rigidly supported around the edges, they sagged and buckeled under the head and were all eventually replaced by brick hearths.

The roasters were all provided with the usual gas outlet at the top hearth and an auxiliary gas outlet at the lower hearth. Oil burners were provided on the three lower hearths. In normal operation not much fuel was required. Sometimes a furnace would operate for days without any fuel, but ordinarily one burner would be in operation on the fifth or sixth hearth and the furnace down-drafted so that most combustible gases, which were low in sulphur from the lower hearths, would go direct to the stack, and the gases from the upper hearths would go to the acid plant. No gates or dampers inside the furnace were provided, the regulation of the dampers in the flues being sufficient to give the desired control. This system of draft control was satisfactory, giving extra heat and an increased sulphatizing effect on the lower hearth, and was always used even when the gases were not being sent to the acid plant.

Both plants had Cottrell installation sufficient for all the gases, but when the gases from the lower hearth were kept separated from the other gases, they went direct to the stack and no provision was made for sending them through the Cottrell.

Flue dust from the main flues where the height of the flue permitted, was returned automatically to the third hearth of the furnaces and the rest of the flue dust and dust from the Cottrells was taken in cars to the concentrate storage and mixed with the concentrates.

Roasted Concentrates Pass to Solution Launder

Concentrates were discharged from the lower hearth through a small screen directly into the solution launder underneath the furnace. The small reciprocating screen removed the lumps and to some extent regulated the flow of roasted concentrates, which would otherwise be discharged in batches of 40 to 60 lb. every time the roaster arm passed the discharge opening. Some mechanical difficulty was experienced with these screens due to the heat and dust from the calcines. At Ordzhonikidze they were replaced by small trommels, which worked satisfactorily, and at Chelyabinsk the troublesome details were corrected and the reciprocating features retained. A second discharge opening was left in the bottom hearth of the furnace so that in emergency the calcines could be discharged on the floor into a car. This system of discharging the red-hot calcines directly into the leach solution was a satisfactory one and seemed to give some advantages in the leaching process. Additional heat was put into the system at a point where needed, and the introduction of all the hot calcines into the neutral leach seemed to constitute an active neutralizing and precipitating agent for the copper, iron, and other impurities in the solution.

Copper in the concentrates at Chelyabinsk was very high, sometimes running to 5 per cent, and a great deal of trouble and expense from this copper had been predicted at this plant which did not materialize.

The launders discharged into a small surge tank and from there the pulp was pumped to the neutral pachucas in the leaching building. At this point the advantages of a careful layout and cascade construction were evident, as this pump pipe line was probably the most troublesome unit in the whole plant. Had the roaster been placed at a higher level with the neutral pachucas adjacent to the roasters, the pump and pipe line would have been eliminated. A lead pump or air lift would have had no difficulty with the

clear solution going to the roasters.

One group of fourteen 9-ft. diameter by 22 ft. high pachucas were provided for the acid and neutral leach, arranged in a double row for greater flexibility between them so that almost any combination could be used or cut out for repair. Usually four or five neutral and two acid pachucas were in operation. The central tube of the last neutral pachucas was made about 6 ft. longer than the others and discharged into a small sand-collecting box about a meter square. Through this box the coarse sands were discharged directly to the first acid pachucas and through an opening in the bottom. Only the overflow went to the neutral thickener. About 50 per cent of the material was short-circuited in this way and all sands were kept out of the neutral thickeners. The flow through the bottom opening was controlled to regulate the amount of solution in the two branches of the leach and also as one of the ways that acidity of the acid leach was regulated. Spent electrolyte was returned from the electrolytic plant by air lifts and all of it went to the acid leach, although provision was made for adding acid to the neutral leach, but after the early operations this was entirely abandoned.

The four neutral thickeners were 50 ft. in diameter by 15 ft. high. Overflow was by gravity to the purification department, and the underflow was collected at a central sump and pumped to the acid pachucas. Usually no trouble was experienced with dirty solution from the neutral thickeners. Overagitation apparently was the cause in one instance, but cleared itself up before the real trouble was ascertained. Concentrates from the Ridder mines, in the Altai district, gave distinctly more trouble from colloids than those from the other mines.

Mechanical agitators were used in the purification section. The plate filters were elevated so that the discharge was by gravity to storage tanks and from there by gravity to the pumps in the electrolytic department.

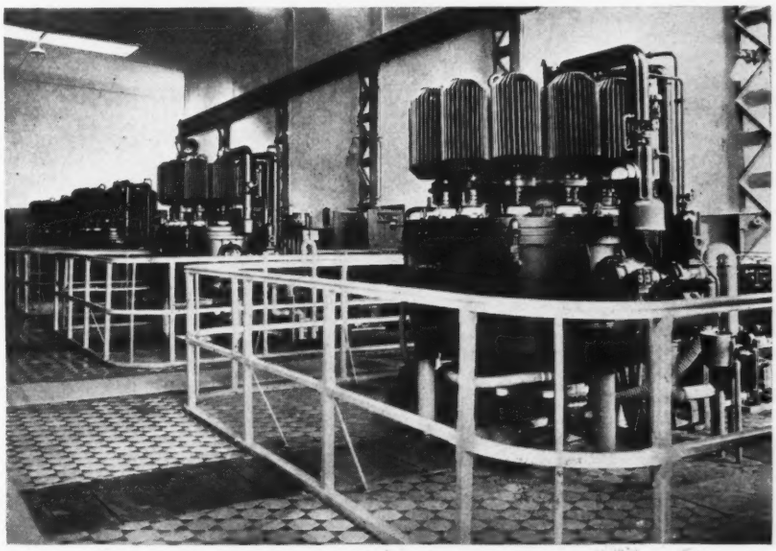
Zinc dust was produced in a small department separated from the other departments on account of danger of explosions, although we never had any. The apparatus consisted of a small oil-fired furnace about 3x6 ft., a graphite crucible set in the flue with a $\frac{1}{8}$-in. hole in the bottom for pulverizing feed, and a simple U-shaped nozzle for the 100 lb. of air. The dust was blown into one end of a chamber of sufficient width and length so that the zinc dust would not impinge on the sides or ends. At Ordzhonikidze, when zinc dust was wanted, the blower was shut down and the workers entered the dust chamber and shoveled up the desired quantity of dust. At Chelyabinsk the bottom was raised about 3 ft. and sloped slightly, so that the dust was easily raked out of a small door at the sides into a small car which traveled on a level track to the purification department. Zinc slabs from the distillation plants were used exclusively for making dust, as it was desired to conserve the electrolytic zinc as much as possible and the distillation zinc, due to its impurities, proved to be the much more active agent for purification of the solutions.

Purification was a batch operation and no attempt was made to settle or decant the purified solution from the purification agitation other than that the discharge pipe was connected to the tank about a foot from the bottom, which allowed some of the coarser zinc dust and precipitates to settle and be left over for the next batch.

Plate and frame filters were used for filtering the purified solution. Iron plates and frames were used at Ordzhonikidze and wood plates and frames at Chelyabinsk. The iron plates were more popular with the workers, but the actual difference from an operating point of view was small.

Thickeners, Moore filters, and Oliver filters to dewater the residue from the acid leach were provided in the plant as designed, but owing to delays in securing proper materials, especially for the Moore filter, the plant at Ordzhonikidze was started without this apparatus. The acid thickeners were used as simple settling tanks, and when one was full the pulp was switched to the other tank, the solution drained off, and then the residue repulped with water and pumped to a settling basin. The overflow from the settling basin was used for make-up water and recirculated for repulping the settling tanks. This system worked so well that no effort was made to complete the filtering system at Chelyabinsk. The cake in the settling ponds was as dry and as free from water-soluble salts as the cake from any filtering system.

The plants were both designed with



Mercury arc rectifiers for zinc electrolysis at Ordzhonikidze. They were manufactured abroad, although most of the other equipment was built in the Soviet Union

Casting slab zinc at Ordzhonikidze. The plant has a rated capacity of 20,000 tons of metal per year

a Waelz furnace for treating the residue, but these were not completed before I left, and, although they have since been placed in operation, I have little information on how successful they were or what their difficulties were. I expected lots of trouble from them, and instead of using them I rather favored some form of a hot-top blast furnace for fuming off the zinc and lead and recovering the other metals as matte, but was overruled on this point.

The electrolytic department was run on the low-current-density and low-acidity basis, but otherwise did not much resemble the Great Falls and Trail systems. Instead of a basement under the electrolytic cells, they were set on masonry piers high enough above the ground level so that the lower floor under the cells was as light, well ventilated, and accessible as any first-story room. The cells were all on the same level and constructed in groups of 25 cells each placed side by side. Six groups of 150 cells constituted an electrical unit. Between the cells was placed a small triangular distributor bar which gave the common contact between the anodes of one cell and the cathodes of the other. A notch in the end of each anode and cathode bar gave a two-point contact with a wedging effect which was very satisfactory, but at Chelyabinsk, when it was time to start the second unit, the triangular bars could not be secured and so they were left out and the end of the cathode bar was supported directly on the end of the anode bar in the next cell. The cathode bar was also grooved longitudinally so as to give a two-point contact with a slight wedging effect. This was so satisfactory that all the triangular bars were removed and the cathode-to-anode contacts were adopted exclusively.

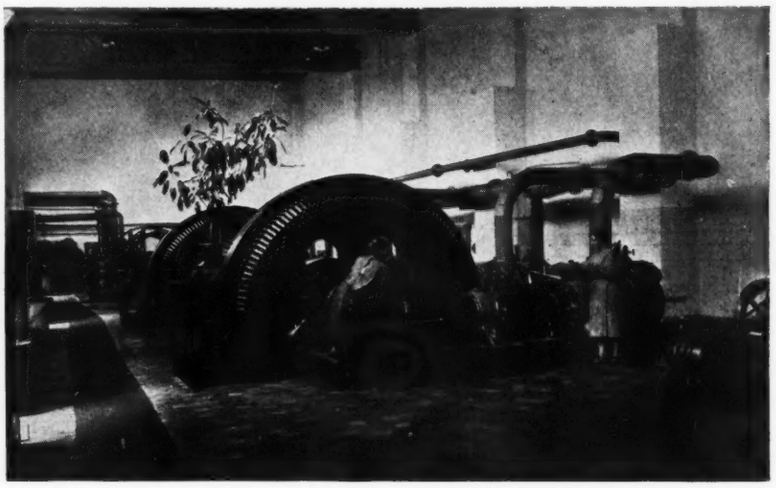
This arrangement left one cathode in each cell with only one side exposed to the current, but this never caused any trouble. The side with zinc on was stripped and the other side left to itself. In addition to the minimum number of contacts and the ease with which they were cared for, there was an unforeseen advantage in that, in case of a short between the anode and cathode, the entire current of the circuit did not all flow through the point of trouble, as there was no connection between the various electrodes, and the trouble was localized to a considerable extent.

Each cell had room for 22 cathodes each with one meter active area, and the electrical load was normally 9,000 amp. and 575 volts per section. This gives a current density of about 40 amp. per square foot. Each cell had an individual feed and discharge pipe, and regulation was very little trouble. The inspector carried a simple wooden hydrometer adjusted in the discharge sump at each shift by a rubber band set at the proper point. As he made his rounds, each tank or whatever he suspected was tested and the proper regulation in the flow made, his job being to keep the gravity of all tanks alike. The general acidity of the collective discharge was tested hourly and the rate of feed to the department adjusted accordingly. The plant was designed with a small head tank and overflow, so that, if the head tank was kept full, a uniform pressure was maintained at all times on the solution feed pipes. The general acidity was regulated by regulating the valve in the suction of the pumps. In actual practice the feed was usually allowed to be slightly excessive and when the acidity became too low, the pumps would be stopped a half an hour or so, shutting off the circulation instantly and giving every one a chance to make minor repairs and adjustments.

At Ordzhonikidze several different ways of stripping cathodes were tried and the most successful seemed to be a method similar to that used at Kellogg, where one cathode was lifted out from each cell and left hanging to drain. The whole row would then be taken on hand trucks to a central point to be stripped while a set of stripped cathodes would be placed in each cell, and then the same operation was repeated on the next row.

Stripping at Chelyabinsk was done on the top of the tanks on a light wooden platform covering one tank and resting on top of the electrodes. It would be moved after stripping two or three cells. Each stripper had two short wooden rods with a hook on each end with which he lifted the cathode free of the solution and hooked the top end of the rod in a wooden stringer in the structure just above his head. He would start with two cathodes, and after one was stripped, put it back in the cell and raise another, leaving it hanging to drain while he took the other, which by then was drained, and stripped it. The stripped sheets were laid on the end of the platform and collected by the tramming crew. This operation was rapidly performed and about 350 cathodes was the normal day's work, although over 400 was often obtained. The stripper cleaned the contacts and was responsible for the correct placing of the electrodes, but did not tram the cathode sheets.

Every day two cells were cut out and carefully cleaned in each section. The cells were cut out by removing the cathodes and anodes and replacing them as removed with a long copper bar across the two tanks. When all the anodes and cathodes were removed, the tanks had twelve bars across them uniformly spaced. An opening in which to work was then made by means of a short copper plate placed under the ends of three or four electrodes in the adjoining tanks, and the three jumper bars were moved to one side as desired.



Compressor room for the electrolytic department at Ordzhonikidze. Note the small trees. Flowers and shrubbery are commonly found in all plants in the Soviet Union

The cells were cooled by a lead coil in the feed end of each cell. Cooling water at Chelyabinsk was provided partly by pumping direct from the river and partly by circulation through a spray-type cooling pond. The intake at the river was just below the discharge of the condenser water from a large steam power plant, so it was usually of little use as a cooling medium; hence the cooling pond for water for cooling the solutions. At Ordzhonikidze, water was supplied by gravity from a cold mountain stream that was always cool even in the hottest weather.

The cells were of wood and lead-lined and supported on wooden timbers on masonry piers. The aisles between the rows of cells were wood planking. Cathodes were moved on hand trucks across scales for weigh-

ing and then sent directly to the casting furnace.

The casting room was adjacent to the electrolytic room and the cells were on the same level as the charging floor of the casting furnace, so the transportation problem was simple. The cathodes were charged into the furnace without washing, directly from the trucks. The furnace was of normal construction, a tight steel shell with firebrick lining and oil fired. At Ordzhonikidze the zinc slabs were cast into stationary molds from a ladle suspended from an overhead track. At Chelyabinsk we constructed a circular casting machine which ran continuously. The molds on one side cut into the ladling well, which projected from the side of the furnace, and the ladler had only to stand still and ladle the zinc into the molds as they moved slowly past them. Another operator dumped the molds and stacked zinc in piles ready for shipment. Dross was generally shipped to a lithopone plant and not much attempt was made to clean out the metallic zinc that was mixed with it. When occasionally it was necessary to re-treat the dross, it was taken to the lower floor of the electrolytic building and dumped into the sump with the spent electrolyte.

Handling Ventilation Difficulties

The ventilation problem at the two plants was entirely different. At Ordzhonikidze there was never any trouble from gas and the tank room was comfortable without a mask, whereas at Chelyabinsk there was constant complaint about the gas condition and it was impossible to get sufficient ventilation. Curiously enough, the complaints all came from the various commissions which were continuously inspecting the plant. Simple gauze masks were provided for the men and considerable quantities of glue were used in the solutions. Also, when the supplies were available, the surface of the cells was kept covered with a layer of cork shavings. It was noticeable that at Ordzhonikidze, where large quantities of glue were necessary on account of the cobalt in order to produce zinc, it was not difficult to get the workers to add it regularly and according to instructions, but at Chelyabinsk, where the glue was necessary only for personal comfort, it was impossible to get the same men to add it regularly and in sufficient quantity. It was also difficult to get them to wear masks. There was never any indication that any of the workers were harmed in any way by the gases. This gas condition was all the more difficult to account for, inasmuch as at Ordzhonikidze there was much cobalt in the ore and, due to corrosion, the current efficiency was lower than at Chelyabinsk. Although at the Ordzhonikidze plant, cobalt in solution built up to over 100 mg. per liter, we operated without any special purification for that element or serious difficulty. The cooling water was about 7 deg. C. in the hottest weather and this made it easier to keep solutions cool. We also always dropped the acidity of the solution when the cobalt was bad, usually operating with about 80 grams H_2SO_4 per liter against 110 grams per liter at Chelyabinsk. This low acid with the consequently increased circulation did not cause any trouble in the leaching department but added about 10 per cent to the power cost, 5 per cent for increased resistance, and 5 per cent on account of lost current efficiency.

The residues were shipped to the various lead and copper smelters, a considerable quantity going to America, to the Tacoma smelter I believe, and large amounts were stored for future treatment. The chief value of the residues was in gold, this varying from 20 to 40 grams per ton; the residues from the Ural concentrates were high in copper, and those from the Altai or Caucasus were high in lead.

A cadmium department was built for each plant to treat the copper cadmium cake from purification. The cadmium content of the Russian zinc ores is not high, but the production of 20 to 25 tons high-grade cadmium per year was a real contribution to the needs of the country. Arsenic was present in only insignificant amounts, so the process was much simplified. The purification cake was leached for cadmium and zinc, the copper settled out, and the cadmium precipitated, filtered out, and redissolved. The solution was then electrolyzed at low current density and voltage for cadmium cathodes. A shunt circuit from the zinc electrolysis was used for power. No roasting was used before any of the various leaches, the filtrate and spent electrolyte were returned to the zinc plant, and the copper cake was shipped to a copper smelter.

Current for electrolysis for both plants was furnished by mercury arc rectifiers and this proved to be entirely satisfactory in every way.

Equipment Soviet-Made

All the equipment except the mercury arc rectifiers, a few bronze pumps and the Oliver filters, which were never operated, was manufactured in the Soviet Union. Much of the equipment such as the roasting furnaces, many pumps, thickeners, and all the electrolytic plant and leaching equipment, had to be detailed complete in the designing office, as they were the first to be produced in the Soviet Union. In any addition to the plants it is planned that all equipment, including the mercury arc rectifiers, will be of Soviet manufacture.

This article has been written largely in the past tense as it is some eighteen months since I left the Soviet Union, and though I understand that both plants are still operating substantially as they were, there have probably been some changes since then. They are operated, however, except for times when they are short of concentrates or power, at or above the full rated capacity. They are successfully operated entirely by local engineers and workers. One or two other electrolytic zinc plants are projected or under construction and both plants have been slightly enlarged and further extensions are planned.

Two New Industries

These two plants with their zinc and cadmium departments constituted two new industries for the Soviet Union. Foreign experience and data were called upon in many days in the design of the plants. The construction, starting up, and operation of the plants, however, except for what little I was able to contribute, were carried on entirely by the Russians, mostly young engineers who had received highly specialized and intensive and none too practical training.

There was no great need for the super grade of electrolytic zinc and no attempt was made to produce it. The slab zinc from the Chelyabinsk was consistently around 99.95 per cent, and that at Ordzhonikidze was slightly lower, averaging 99.93 per cent.

Contrary to the recorded experience of many engineers who went to the Soviet Union during the periods of the first and second five-year plans, I, during my seven years in the nonferrous industry there, had rather favorable relations with the Soviet engineers and workers. It required infinite patience to get one's ideas over, and the language and method of thought were almost insurmountable barriers, but once an understanding was accomplished and direct personal confidence established, it was apparent that both the engineers and workers were as intelligent, as willing to work and follow orders, as any I have had to work with anywhere. Certainly there were many Russians who worked for and with me in my seven years there in whom I had every confidence as to their loyalty and ability once they understood what was wanted. Individual workers continually produce as many units of work as do similar workers in America and the great disparity between the production per inhabitant in the United States and the Soviet Union must be attributed to other causes, of which there are many, than the lack of intelligence or lack of industry of the individual engineer or worker. To go into this, however, would require much more space than is here available.

Fifteen Years of Mining
In the Turkish Republic

The mineral resources of the country are being successfully developed under Government auspices and the beginnings of a metallurgical industry have already been made

THE development in the Turkish Republic of a national economy which has been successful in spite of adverse conditions in the ore and metal markets, and the increase in the production of ores and in their consumption at a time when such production and consumption were dropping in other countries, are the result of the conscientious efforts made in this field by the Republican régime. A review of the situation of the mining industry under this régime will aid in understanding this development.

The coal basin of Zongouldak, one of the principal sources of Turkey's wealth, was discovered in 1828, and up to 1865 its annual production had not exceeded 50,000 tons, the country meanwhile importing the coal it needed. To remove the unpleasant impression thus produced, the Government, in 1865, authorized the Navy Department to exploit the coal basin. At the time of the revolution of 1908 this responsibility was transferred to the better-qualified Ministry of Commerce and Agriculture. Production from 1865 to 1937 totaled approximately 28,750,000 metric tons, passing the million mark for the first time in 1926 and the two million mark in 1934, the output in 1937 being 2,306,869 metric tons.

At the time the coal production of Turkey was increasing almost steadily, that of the world was dropping, falling under the effect of the crisis from 1,332,600,000 tons in 1929 to 690,000,000 tons in 1932. The price of the coal in the international market, which was $5 gold in 1929, fell to $2.68 gold in 1932. Despite these fluctuations outside of Turkey, the coal market was stabilized within the country. The Turkish market did not attain the rise which came in 1937 in all foreign markets. The Government, taking into consideration the important rôle that coal plays in the industrial life of the country, kept prices at their usual level.

Thus it is apparent that the Government followed an economical policy with regard to the Zonguldak coal basin, having the purposes and principles well defined. The four-year industrial plan announced recently by the President of the Council, Celal Bayar, gives to this coal basin a definite guide for the future. In this connection two important institutions were founded for the purpose of developing the mineral resources of the country. One of them is the Eti Bank, which started late in December, 1935, on its work of developing the mines and erecting electric power plants throughout the country. The Ereyli coal company, formerly run by French capital, was bought out by the Government and given over to Eti Bank's control for exploitation. The other of the two institutions is the "M.T.A." or the Institute for Research and Prospecting, which was set up for the purposes indicated by its name.

Chrome ore constitutes one of the country's most important natural resources. The ores are of good quality and the country is well situated geographically. The Government has taken the steps necessary to the end that chrome may occupy the place it deserves in the economy of the country. In 1923, in which year the Republican régime was proclaimed, exportation of chrome was nil; it amounted to 3,400 tons in 1924. Since then, the output has risen almost steadily, passing the 50,000 ton mark in 1932 and attaining 192,508 metric tons in 1937. This increase is the fruit of strenuous work by the Government, won despite the anarchical situation created by the world crisis and the existence of powerful and well-equipped competitors. The reserves will permit the rapid pace of production to continue.

Besides the mines of Kutahya, Eskisehir, Denizli, Tefenni, Marmaris, and Mersin, already known, the Eti Bank has recently set up a corporation to exploit the chrome deposits of the Guleman region. The Institute of Mining Research also has listed important deposits which are found in the Province of Elazig. Eastern Turkey is really a chrome province. The places where the deposits are situated are as follows: Guleman (Sasin, Tosin, Sayver, Gulalin, Bani); Kundikan; Sorudagr; Kafdagr; Bahru Beseren; Asagi Hamel (Buyuk Hamel), Karaceesme, Rutdagr, His, Boban; Asagr Vertenik (Ahirderesi); Yukari Sirnak; the high plateau of Harput; Bagin; and Mihman. These deposits occupy an area 30 by 18 km. in extent.

Lead and Zinc—The only lead mine producing up to the institution of the Republican régime was that of Balya-Karaaydin. The economic crisis having seriously shaken the standing of this company, it was about to stop work when the Government decided to take steps to protect it. The mine is now producing lead and zinc ores and exporting the flotation concentrates.

The Anamur lead mines, which began operation under the Republican régime, are exploited by a Turkish company.

Recent surveys indicate that the mine of Bolkar-Dag, in the Province of Nigde, is a deposit which is being exploited. The Eti Bank has taken the necessary measures for putting this mine in operation. The Keban argentiferous lead mine, in the western part of Elazig, will be opened at the same time.

The production of zinc concentrates rose from nothing in the latter part of 1926 to 11,500 tons in 1929, and after dropping to approximately 600 tons in 1931, rose again to about 17,000 tons in 1936 and 1937.

Copper—To place the copper mines,

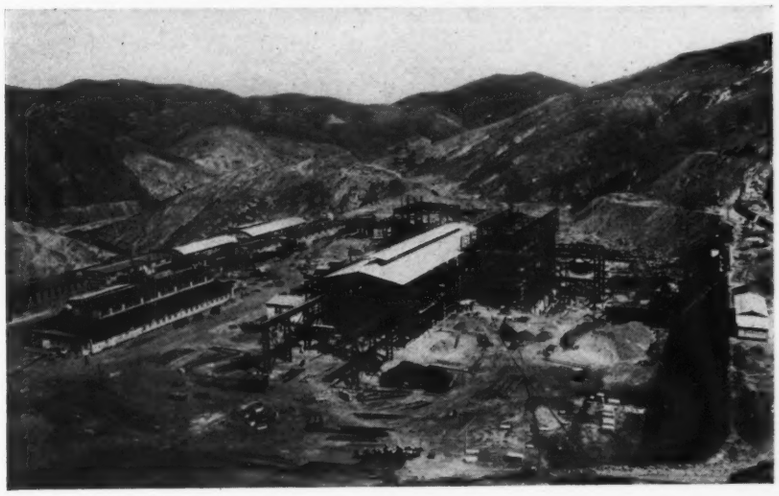
Six Months' Export of Ore

Ore	1937 Metric Tons	1938 Metric Tons
Asbestos	79	549
Antimony	628	336
Copper	200	799
Boracite	2,332	4,064
Mercury, flasks	241	275
Cement	107,397	132,558
Zinc	8,572	12,200
Zinc lead	3,372	7,039
Millstone, pieces	2,032	3,075
Lead	3,992	4,350
Sulphur	1,383	4,000
Chrome ore	96,254	118,956
Lignite	58,199	65,749
Mineral water, liters	490,021	480,385
Manganese	265	263
Magnesite	675	682
Marble, cu. m.	65	172
Molybdenum	91	27
Coal	1,130,299	1,284,091
Emery	6,058	3,567

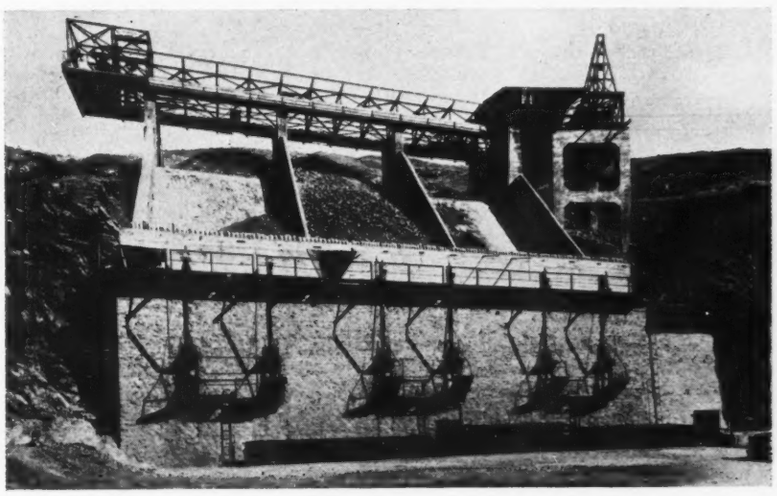
Translated and rearranged from the French of "M. T. A." bulletin of the Turkish Institute of Research and Prospecting, Ankara, Turkey.

which have long remained inactive, again in operation constitutes one of the basic objectives of the Government economic program. The systematic work undertaken should soon show results. In fact, the Ergani mine has already begun producing Standard copper in 1939. The annual production of the company will be 12,000 tons.

Eti Bank has also taken the necessary steps to work the Mourgoul mine, in the Province of Artvin. Plans have been prepared and construction of the plant, which will be larger than that of the Ergani mine, has begun. The mine's annual capacity will be approximately 12,000 to 15,000 tons.



The new copper smelter recently erected at Ergani. The plant has been completed since this photograph was taken



Chrome ore is delivered to these bins at the railroad station at Ergani by aerial tramway from the Guleman region, 20 miles away

The Kuvarshan copper mine, in the Province of Artvin, has been in operation for two years. After the foreign company, which had been working it, suspended its activities due to the crisis, the Government decided to put it in operation. The Eti Bank, which took possession of it, immediately completed the plant, with the result that the Kuvarshan is now in the exports list. Its annual capacity is about 2,000 tons. In six months of 1938 it exported 799 tons, against 200 in the corresponding period of 1937. At this pace, the exportation of copper from the Kuvarshan mines is expected to increase rapidly.

Various Ores—Besides the properties mentioned, there are mines of emery, antimony, mercury, boracite, and sulphur likewise operating in Turkey.

After the World War, emery was found to be among the products most affected by the economic crisis. Production, which was 11,145 tons in 1928, dropped to 7,600 tons in 1929, and 3,267 tons in 1930. Thanks to the measures taken by the Government at the beginning of this period, exports increased, to reach 12,115 tons in 1937.

Antimony mines were likewise practically inactive. As a result of exploitation started in recent years, production attained 223 tons in 1935, 1,070 in 1936, and 1,255 tons in 1937. Antimony is produced principally in the vicinity of Turhal. It is expected that, due to the efforts of the Institute of Mining Research, the production capacity of this region will soon show a considerable increase.

The sulphur mines of Kecibourlu have resumed operations, adding to the country's sulphur output. Production has risen from 12 tons in 1928 to 2,929 tons in 1936 and to 3,384 tons in 1937. Outside of the Keciburlu mine, sulphur deposits have been found at Canakkale, Izmir, Deniti, and Bayazit, and have been examined by the Institute.

In speaking of Turkey's mineral production, one must not fail to mention the cement industry, which is benefited by the protection of the Government. The production of cement has increased rapidly. Beginning in 1925 with an output of 6,847 tons, it reached 214,794 tons in 1937.

What of the future of Turkey's mining industry? The Government has taken effective measure to encourage the production and exportation of ores, which play an important rôle in the assets of the country's commercial balance sheet. Desiring to make an inventory of the mining wealth of the country, it set up the aforesaid Institute of Research and Prospecting for this purpose. In a relatively short time, the Institute has examined a large number of mining properties and has turned them over to the Eti Bank for development. Certain deposits, moreover, have been discovered only recently, which have been shown to be of merit upon examination.

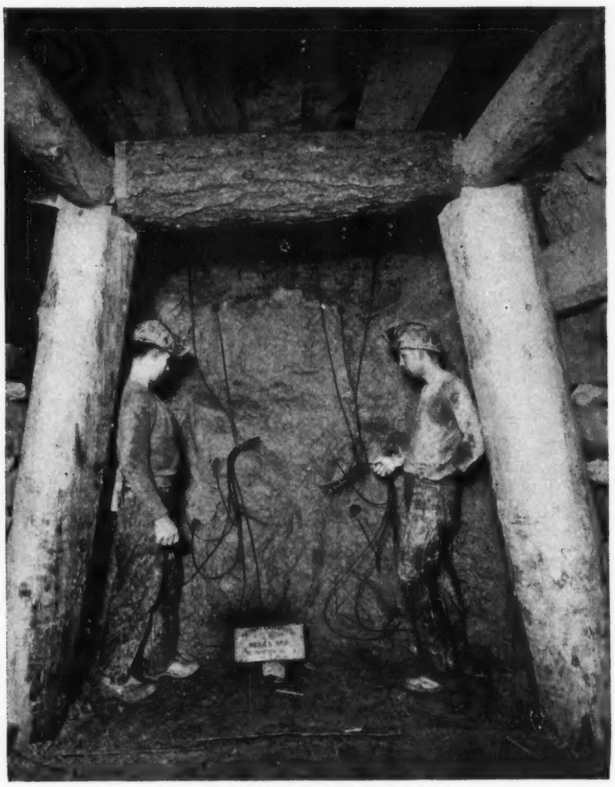
As a result of a survey of an area 20 km. south of Kutahya, a deposit of lignite representing a reserve of some millions of tons has been found. The geology of the region around Seyitomer makes probable still larger reserves. This discovery has made it possible to establish an industrial center in this region, and the Government is considering the matter.

Establishment of a metallurgical industry in Turkey was considered some time ago as one of the national problems awaiting solution. Today a center of metallurgical production is under construction at Karabuk, which will draw its supplies from the ore deposits. This object has been attained, thanks to the positive results of the surveys made at different points of the national territory. Particularly worthy of note are the iron deposits at Divrik, which not only will suffice to meet the requirements of the country but will also permit the export of some ore. At Espiye a pyrite deposit is being examined, which is said to be important. The examination of lead occurrences in the region of Prajman continues encouraging.

Handling Explosives in the Butte Mines

Attention to details marks Anaconda's practice

Emil H. Sauve
Engineering Research Department
Anaconda Copper Mining Company,
Butte, Mont.



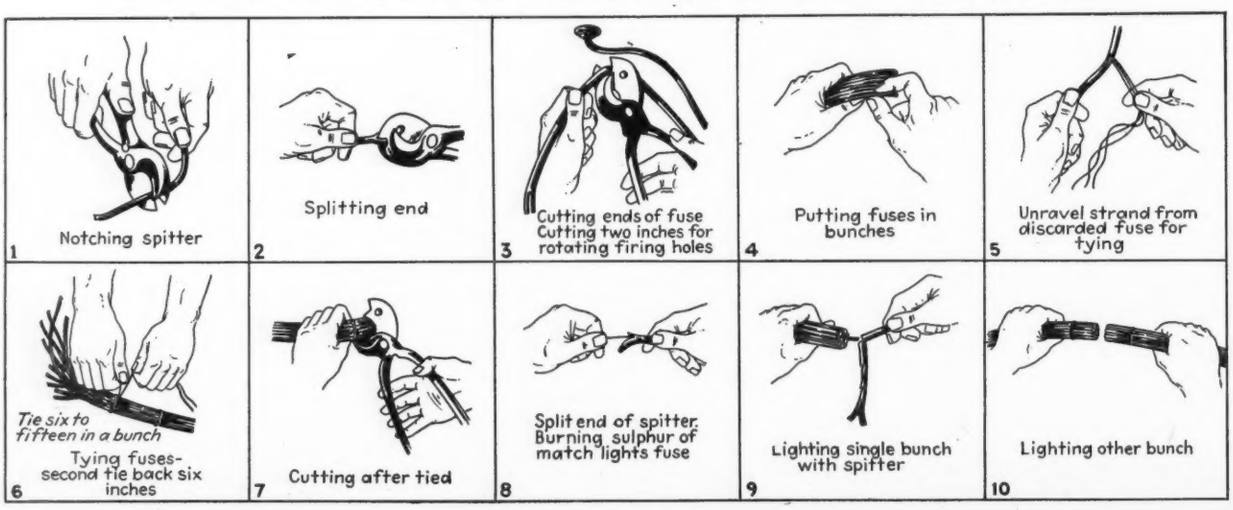
A round loaded for shooting by the bunch-blasting method. Note the two bunches of fuses

ALL POWDER used by the Anaconda Copper Mining Company at Butte is purchased from one manufacturer, who has a magazine 10 miles west of the town. At the mines, the shift boss appoints a powder magazine man for each level. This man, who may be the car dumper, the nipper, or the track cleaner, has the key to the powder magazine and issues powder and fuse to the miners during the shift. He also checks the powder and fuse on hand and orders new supplies with the timekeeper in the mine office. On Monday of each week the timekeeper makes out an "all mines" requisition and sends it to the warehouse, where the order is placed with the powder company the same day. On Tuesday morning the powder is loaded on a railroad car and dispatched to the mines' warehouse. The powder is immediately loaded on trucks and sent to the different mines. When the truck arrives at the mine a signal is flashed and all hoisting stops. The boxes are unloaded, placed in special wood-lined steel powder cars, and taken to the underground magazines. The car is standard for all mines and holds twelve powder boxes of the present customary size.

The cage tenders have the powder lists for the various mine levels and load and lower the cars accordingly. As soon as a car of powder is spotted in a station, the motorman and his helper push it by hand to the powder magazine, where it is unloaded. Boxes of powder remaining from a previous order are moved to the front of the magazine and the new ones are placed behind them to insure that the oldest powder is used first. Each box is stamped with the date that it leaves the manufacturer's magazine west of the town.

To maintain close supervision on powder consumption in working places, the shift boss visits each of

Bunch blasting is extensively used in the Butte mines. The steps are shown in preparing the fuses of a round.


1 Notching spitter
2 Splitting end
3 Cutting ends of fuse Cutting two inches for rotating firing holes
4 Putting fuses in bunches
5 Unravel strand from discarded fuse for tying
6 Tie six to fifteen in a bunch
Tying fuses- second tie back six inches
7 Cutting after tied
8 Split end of spitter. Burning sulphur of match lights fuse
9 Lighting single bunch with spitter
10 Lighting other bunch

(b) Weekly Powder Report

Contract No.	Place	Shift	No. Holes	No. Sticks Powder & Grade	No. Sticks Tamping	6 more columns for remaining 6 days of the week	Total Sticks Powder No. 1 Gelex	Total Sticks Powder No. 2 40% Gel.	Total Sticks Powder No. 3 60% Gel.	Total Holes or Primers	Total Sticks Tamping	Total Powder Money	Total Primer Money	Total Expl. Money	Excavation	Cost per Cubic Foot Exc.	Last Week Cost	
		D. S.																
		N. S.																

Size of sheet 13″ x 22″

(c) Mine Inventory of Powder

Mine ..... Date .....

	Brand	Size	Strength	Quantity
Powder on hand 1st of month				
Powder received during month				
Powder on hand last of month				
Powder used				

Brand	Size	Strength %	Quantity Used				
			Drifts	Raises	Stopes	Misc.	Total

(a) Miner's Powder Order

.....

No. 73451

Date.....Contract No.....

Sticks Powder.....%.....

Sticks Powder.....%.....

Number of Holes.....

Sticks of Tamping.....

Reblasting.....Chutes.....Plugs.....Missed Holes.....

.....
Shift Boss

Fig. 1 . . . (a) Powder order issued to miner by shift boss before end of shift. (b) Weekly powder report made by safety engineer (c) Mine inventory of powder

Fig. 2 . . . Recapitulation for all mines of monthly reports made by fuse man and safety engineer. It is made at end of each month

All Mines. Fuse, Powder, and Cap Report

.....193....

MINE	Primers on hand 1st	Primers Made Up											Fuse Inventory				Cap Inventory			
		Number of primers prepared						On hand last of month	Total primers used	Total feet prep'd	Ft. of fuse per primer	Primers dipped cel a cap	Reels on hand 1st	Reels rec'd	Reels on hand last of month	Total ft. of fuse used	Caps on hand 1st	Caps rec'd	Caps on hand last of month	Number caps used
		6 ft.	8 ft.	10 ft.	12 ft.	Misc.	Total													

MINE	Missed Holes					Cost of primers	Cu. ft. excavation	Cost of primers per cu. ft.	Powder Inventory								
	Total holes blasted	Holes missed	Percent missed	Cu. ft. exc. per hole drilled	Holes blasted per miss.				Size	%	On hand 1st of month	Rec'd during month	On hand last of month	Boxes used	Total cost	Cost of powder per cu. ft.	Cost of powder and primers per cu. ft.

Electric Blasting Caps

					Total
O. H. first					
Rec'd					
O. H. last					
No. used					

the places before the end of the shift and issues the miner a powder order (Fig. 1a). The slips are made out in duplicate. The shift boss keeps a carbon, giving the original to the miner, who in turn gives it to the attendant at the magazine when he gets the powder. At the end of the shift, the powder man turns all slips in to the safety engineer, who checks them against the duplicates held by the shift boss. He then enters their data on his weekly powder report forms (Fig. 1b) and these in turn are sent to the office of the Engineering Research Department at the end of the contract week.

A recapitulation (Fig. 2) is made at the end of each month by the Engineering Research Department from the monthly reports sent in by the fuse man (Fig. 3) and the safety engineer (Figs. 4 and 1c). This recapitulation (Fig. 2) is then sent to all mines.

Fuse is ordered once or twice a month. A safety fuse having a burn-

ing rate of approximately 1 ft. in 40 sec. is used and is wound and shipped on metal reels, each containing 3,000 ft. These are left in the fuse cutter's house on the surface.

Caps are ordered every Tuesday, if needed, and come in cases containing 5,000 caps each. A No. 8 cap is used. Caps are ordered and handled in the same manner as is the powder with the exception of storage. A main cap magazine is kept by the Anaconda company at one of the non-operating mines. All caps for each mine are stored in a magazine located in the mine a short distance below the surface and are brought to the fuse cutter's house as needed.

Each mine has its own fuse-cutting house on the surface in which capped fuses are prepared. One man does the work at each mine and spends approximately half his time on that job. The remainder of the time is spent around the yard or in the lamp and bit house. This centralization of the work of capping fuses has practically eliminated misfires due to faulty capping and has made it possible to purchase the 3,000-ft. reels of fuse instead of the smaller 50- or 100-ft. rolls previously bought for underground distribution, and in this manner has reduced fuse costs.

All work of preparing fuse is done on the fuse cutter's bench (Fig. 5) in the fuse house. The fuse rack holds five to six reels of fuse, making it possible to cut that many strands at once. These are laid to one side on the bench until 25 strands have been cut. The fuse man then starts putting the caps on, making certain in each case that the end of the fuse is up against the fulminate. The cutting knife must be sharp and clean at all times to insure a clean square cut. After inserting the fuse, the cap is crimped on by means of a crimper operated with a foot lever. The fuse is cut into 6-, 8-, 10-, and 12-ft. lengths. A few 4-ft. lengths are cut for blasting plugs. To avoid kinking the fuse and for reasons of safety, the capped fuses are made up in rolls of 25 each, with caps on the inside. A tag having the date, length, and destination is tied to each roll before leaving the fuse house. A sufficient number of capped fuses are kept on hand in the fuse house to meet the requirements of one shift. They are made up in the morning, put in special containers (Fig. 6a), and sent underground to the respective levels at lunch time. Each level has a special magazine for storing the fuses (Fig. 7) and is usually situated near, but always at a safe distance from the powder magazine. The end of each fuse is painted, as a safety indicator, so that when fuses are cut for rotation in blasting, the same fuse may not be cut twice.

In all shaft sinking and in wet working places electric detonators are used. These are kept on hand in the fuse magazine on the levels where used (Fig. 7). Delays stocked run from no-delay to No. 10 inclusive (11 cap intervals). No instantaneous electric blasting caps are used.

The practice of blasting with electric blasting caps is explained in Fig. 8. If the rounds are fired electrically with a blasting machine, they should be wired in series. If they are

Monthly Primer Report

Date _____ Mine _____

Date	Total Primers Prepared 4′	6′	8′	10′	12′	Total Primers Sent Underground 4′	6′	8′	10′	12′		Primers Dipped Cel A Cap
1												
30												
31												
Total												

	No. Boxes Caps	Reels of Fuse Full Reels	¾	½	¼	Total
On hand 1st of Month						
Received						
On hand last of Month						

	Lengths 4′	6′	8′	10′	12′
Made up primers on hand 1st of Month					
Made up primers on hand last of Month					

Signed: _____
Fuse Man.

Fig. 3 . . . Monthly primer report made by fuse man

Fig. 4 . . . Missed hole report made each month by safety engineer

Missed Hole Report

Mine _____ Date _____

DATE	DRIFTS Total Holes	Actual Number Missed	RAISES Total Holes	Actual Number Missed	STOPES Total Holes	Actual Number Missed	Remarks
1							
30							
31							
Tot.							

Caps on hand 1st _____
Caps Received _____
Caps on hand last _____
Total Caps Used _____

Electric Caps on hand 1st _____
Electric Caps Received _____
Electric Caps on hand last _____
Total Electric Caps used _____

Signed _____

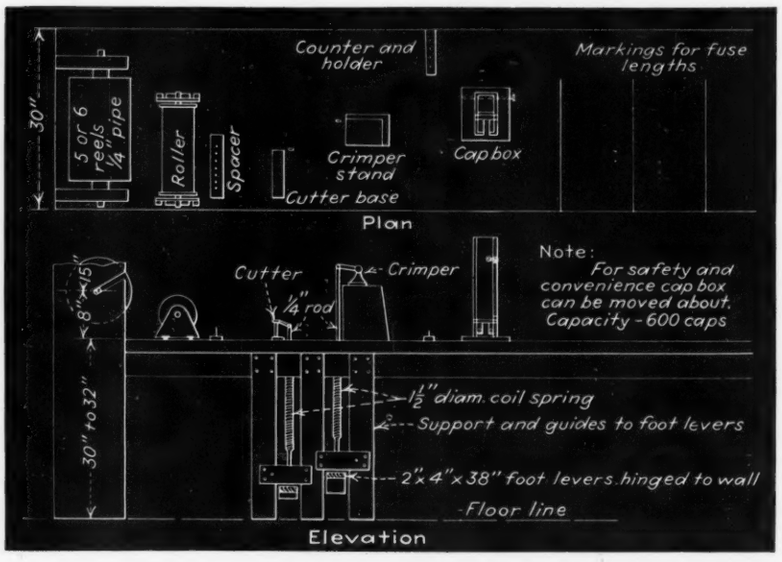


Fig. 5 . . . Fuse cutter's bench in the fuse house. All fuse is prepared on it

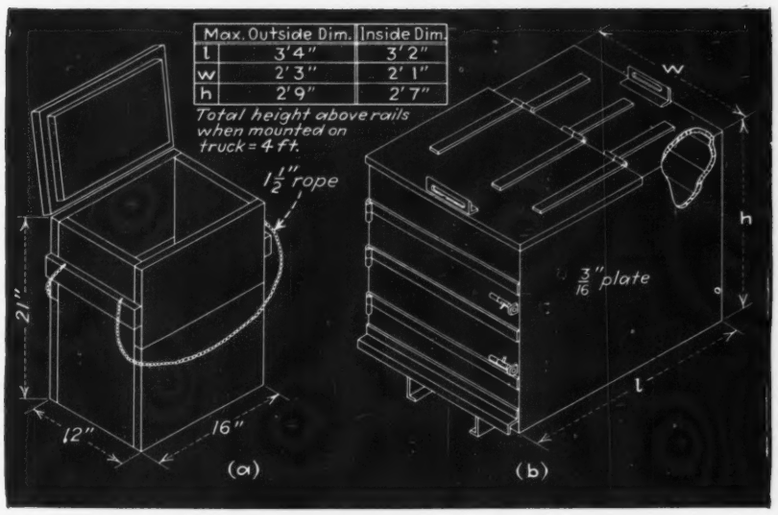


Fig. 6 . . . (a) Underground fuse box, in which capped fuses are sent down at lunch time to the respective levels. (b) The wood-lined body of the steel powder car

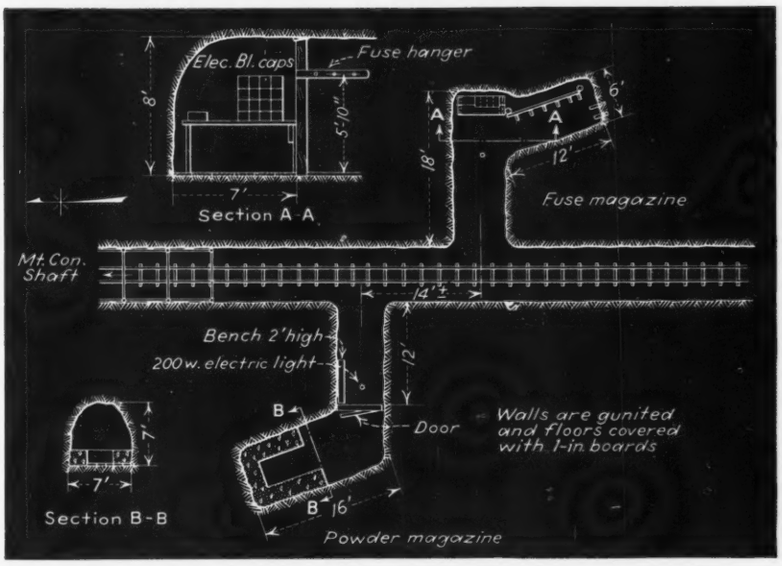


Fig. 7 . . . Typical magazine for storing powder and fuse underground.

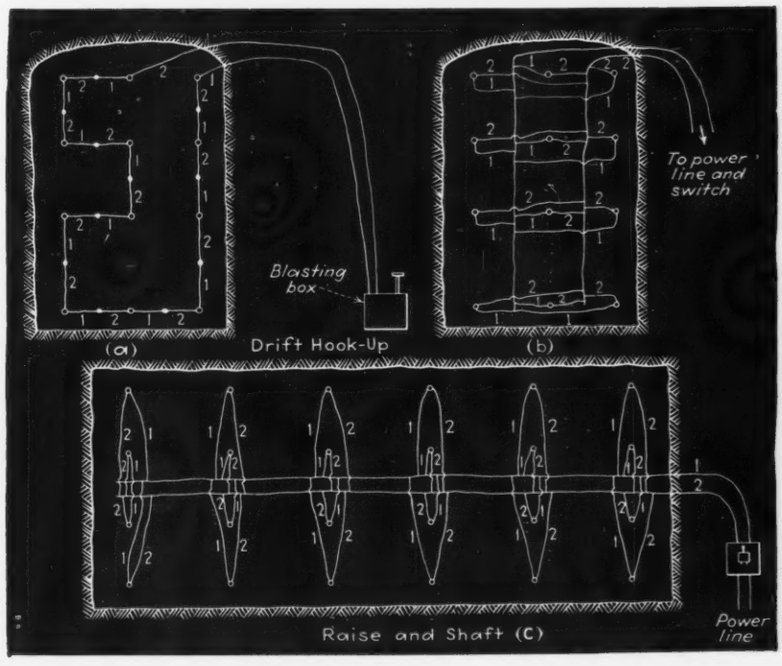


Fig. 8 . . . Electric blasting hook-ups for various conditions. (a) for a drift round with a blasting machine. (b) For a drift round from the lighting circuit. (c) For a shaft or raise round with current taken from power line

fired from an electric current, they should be wired in parallel.

In drift rounds either a blasting machine or an electric circuit is used, depending on how far the power line is from the working place. If a blasting machine is employed to fire the round, the hook-up is as shown in Fig. 8a. The lead wires are carried from the back holes, this to eliminate short circuits which would result if the wires came in contact with pools of water in the drift. The circuit is tested with a galvanometer before the leads are connected to the blasting machine. The lead wires are No. 14 copper wire and are carried back a distance sufficient to insure safety to the man operating the machine.

If the drift round is fired by current from the light circuit, the hook-up is as shown in Fig. 8b.

In shafts and raise rounds the current is generally taken from the power line. The wiring is shown in Fig. 8c. The switch is kept in a special locked switchbox, at a safe distance from the working place. Voltage used is 110. Where necessary, it is stepped down from a 440-volt line by a special transformer.

Bunch blasting, the special technique developed some years ago by the Engineering Research Department for spitting fuses in bunches at a time without the use of a carbide lamp, while keeping the holes in rotation, is carried out as described in the following:

A short piece of fuse is selected for a spitter. This is threaded through the small hole in the fuse cutter and notched at 1-in. intervals, as shown on page 36, sketch 1. The end is then split to receive the fire from a match. Next, the ends of all fuses are cut to allow for the proper firing intervals, using a 2-in. cutoff for the interval. The fuses which project from the loaded holes are then gathered into bunches of 6 to 15. A strand is then unraveled from a piece of fuse and used in tying the bunched fuses as shown in sketch 6. The fuse cutter is again used to trim the ends of the bunches evenly. The next step is to light a spitter with a match, the match being crowded into the powder train of the spitter, as in sketch 8. With this, the fuses in one of the bunches are lighted. The final step is to hold the lighted bunch against another bunch as shown, being careful to move it about in order to insure that all of the fuses are ignited.

This method has proved to be the safest and quickest and most satisfac-

A Novel Signal System for Mine Shafts

It eliminates all open wiring and can be used whether cage is in motion or at rest. . . The hoisting cable serves as medium of transmission

R. L. Rutherford
Magma Copper Company
Superior, Ariz.

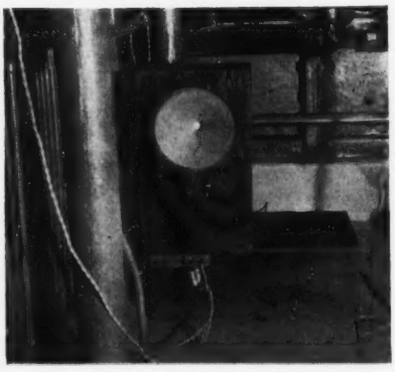
THE desirability and advantages of signaling from moving mine cages have long been recognized by mine operators. As early as 1892 a trolley and bar wire system was developed and a patent was granted to one Frederick W. Bacorn for "certain new and useful improvements in electric signals for mine shafts." The specification states in part, to quote: "As at present constructed there is a rope from the bell in the engineer's room which runs down to the bottom of the shaft, generally outside of the cage, which must be caught by the hands and pulled to ring said bell, a device which is very unreliable and its operation is always more or less difficult when the cage is in slight motion." To this statement might be added the fact that the old mechanical pull line pulls just as hard and is as unreliable as it was in 1892.

From an electrical standpoint, the design of an electrical system by which signaling may be done from a moving cage is not a difficult problem. It is quite another matter, however, to design one that meets requirements from a mining standpoint. The space required for the cage installation is important, and the device must be able to take all the hard knocks encountered in shaft operations. Therein, and not in any electrical imperfection, lies the weakness of most moving cage signal systems. Any open wiring in the hoisting compartments of a mine shaft is subject to conditions physically more severe than such wiring can reasonably be expected to stand. In many instances such systems, using open wiring either as trolley systems or by inductive[1] methods, functioning satisfactorily, though it is obvious that such installations are working under undesirable conditions. Falling rock constitutes a constant menace to wires and insulation. Water, often containing soluble salts, makes proper insulation very difficult.

The electronic shaft signal system was devised to eliminate all open-shaft wiring and to provide a simple, sturdy, and inexpensive device for signaling from a moving cage. The name "electronic" was selected because the device is operated by a vacuum tube. Essential equipment consists of the cage signal boxes which are "grounded" to the cage and the hoist-room equipment, which is also suitably "grounded." The hoisting cables and the shaft walls constitute electrically an elongated electrostatic capacitor. Apparatus designs and frequency of the signal current used are based largely upon this electrostatic component. The net result is the production of a uniform signal throughout a deep shaft even under adverse and varying conditions. A different tone is used on each of the two cages to indicate from which of them a signal is received. A single set of hoist-room apparatus serves both compartments.

As will be seen in the accompanying photographs, a small, entirely self-contained signal box is mounted on the top of the cage. A rope hangs within reach of the cage operator. The hoisting cable is used for transmitting signals to the hoistman. The initial test installation was made at No. 5

Receiving box or loud speaker at hoist house serving No. 5 shaft



[1] An induction system for signaling from a cage at rest or in motion was devised for and installed by the Montreal Mining Company, Montreal, Wis. It was described by the inventor, L. D. Stewart, in *E. and M. J.*, May 25, 1931, pp. 448–449.

▼ ▼ ▼

Handling Explosives in the Butte Mines

(*Continued from preceding page*)

tory yet tried at Butte in lighting fuses underground. It permits a miner to blast a very large round and to make his exit before the smoke from the burning fuses fogs up the working place. It furthermore provides a standard interval of cutting and thus eliminates the danger of mistakes in cutting fuse for this purpose. Care should be taken to grasp the bunch 6 in. back from the ends to avoid burning the hands.

Early in 1934 Anaconda bought a gelatin cartridging machine to be used for making cartridges of stemming and installed it at the Mountain View mine. This is operated by two men, who, it was estimated originally, would spend all their time on it. Outside the building in which the machine is set up, and near the stemming machine, is a bin in which dry stemming material (dry mill tailings) is stored. This bin discharges into a large mixing box inside the building near the machine. The latter is run by a 3-in. Tex-rope drive driven from a 5-hp. 860 r.p.m. 440-volt a-c motor. It has two discharge spigots, each slightly smaller in diameter than the stemming bag and having a portion cut from one end to facilitate feeding the empty bags on to the spigot. Each spigot is at least as long as the tamping bag and has a cutoff valve for controlling the discharge.

One man mixes the dry material with water and feeds the machine while the other handles the bags. The bags are 1½x8 in. when filled and crimped and are made of light, tough paraffined red paper to permit the stemming cartridge to be distinguished from the powder cartridge, so that in case of a missed hole the miner can tell when all stemming has been removed and can then be certain of placing the detonator in the powder and not in inert material when reblasting the hole.

The capacity of this machine is 2,000 sticks per eight hours. The cost of one stick of stemming delivered at the mine is $0.009, based on manufacture of 2,000 cartridges in eight hours.

shaft of the Magma Copper Company at Superior, Ariz., several months ago. It has been in daily use since, and works well under severe conditions. Several other installations will be made as soon as the equipment is available. The signal system is protected by pending patents.

Effect of water, even that containing copper in solution, has been found by actual tests in several shafts to be negligible. Early experiments at the Belmont mine, near Superior, indicated this, and all later work has verified the fact. At the Magma No. 5 shaft no difference in signal strength can be noted in the wet sections of the shaft. Tested in the No. 14 winze the signal strength was uniform throughout the shaft. This despite the fact that the wet parts of the shaft contain copper in solution. During a temporary installation in No. 8 shaft for inspection purposes, the system functioned perfectly. This shaft is very wet from the collar to the 4,000 level, and has steel shaft sets and a steel headframe.

The advantages offered by the electronic signal system are many. Of primary importance possibly are the safety features. In handling men and materials through the shaft, the cage operator has absolute control of the cage at all times. In case of emergency, a stop signal can be given regardless of speed or position of the cage. Shaft inspection and repair work can be carried out quicker, safer, and at lower cost. A simple rope-and-pulley attachment is used for signaling from the crosshead, by means of which it is possible to spot the crosshead of the cage much closer than with conventional methods. The device renders considerable help when heavy machinery, too large to fit into the cage, is lowered down the shaft. As to repair and service work on the electronic signal system, the entire layout can be replaced in less than one hour. A cage signal box can easily be changed by one man in 15 min. Because of its portability, the device may be set up in the shaft for temporary use in a matter of minutes. This feature makes it particularly useful in mine rescue work.

The following work done recently and taken from the daily log book will give some idea of the usefulness of the device described:

Nov. 19, 1938—Shaftmen used the signal system in opening up No. 5 shaft from the 3,600 to the 4,000 level. Regular signals not yet advanced to the 4,000 level.

Nov. 20, 1938—Four loading baskets lowered and installed in pocket on the 4,000 level of No. 5 shaft. Regular signals installed about noon.

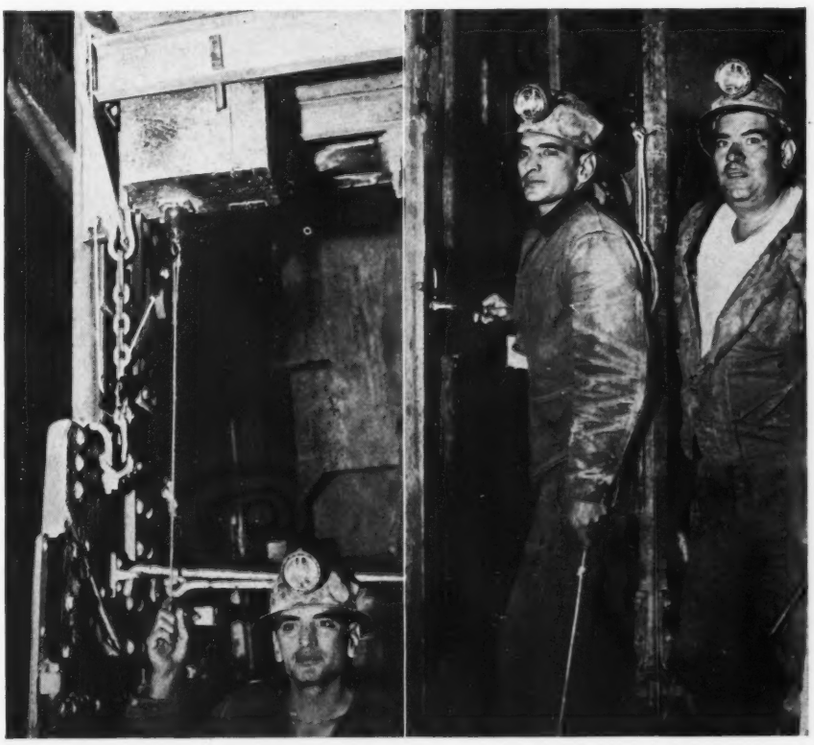
Jan. 2, 1939—Inspected No. 8 shaft to 4,000 level. Regular signal system inoperative due to hoisting equipment not used for several months. Shaft very wet.

March 6, 1939—Lowered A-bottomed cars at No. 5 shaft.

March 25, 1939—While lowering powder the cage in No. 1 compartment of No. 5 shaft struck a lagging below the 3,600 level pocket. Cage operator stopped the cage at once, and after recovering lagging and inspecting shaft proceeded to the 4,000 level.

The accompanying pictures were taken of a shaft repair crew from the 500 station. This repair work was formerly done by three men before the use of the new signal system (two on the crosshead and one signaling). In this special case there is direct saving of $10.90 a day (two shifts) with the additional advantage that about one-third more work was done.

Left—Signaling in No. 5 shaft of the Magma mine. The signal box is seen mounted on the crosshead, with rope attached. Right—The rope and pulley seen in the picture at the left is here being used to signal from above the cage, while lowering machinery too large to go inside



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Crushing and Grinding Studied

CRUSHING and grinding of ores constitute one of the main items of expense in their processing. Will H. Coghill and F. D. DeVaney, of the Bureau of Mines, have brought together the results of years of study in field and laboratory in a bulletin entitled "Conclusions From Experiments in Grinding," this in co-operation with the School of Mines and Metallurgy at Rolla, Mo. Particular attention is given to the factors involved in the use of fine grinding of rod, ball, and pebble mills, of which there are approximately 500,000 connected horsepower in the United States. The ball mill is frequently the "bottle neck" in a plant and often the largest single item in the cost sheet.

In the past the size of balls used in grinding has been largely determined by the size of the material in the new feed. Most of the work of grinding, however, must be done on the nearly finished material. Inasmuch as there is an optimum size of ball to grind a mineral particle of a particular size and hardness, experiments have shown that as much as 60 per cent increase in efficiency can be obtained by correctly rationing the ball charge. This takes into consideration not only the size of the new feed but the amount and size of the ore that makes up the circulating load.

Much attention has been given in recent years to size of material. Formerly many operators sold nonmetallic products on the basis of 200 mesh (74 microns) specifications; now the 10-micron size is the pivotal point. The need for more information on methods of accurately measuring the amount of material in the subsieve sizes prompted the authors to make a survey of equipment available for such determinations.

Wright-Hargreaves
Improves Its Milling Practice

III — *Clarification and Precipitation . . . Clean-up and Refining . . . Mill Sampling . . . Milling Costs*

Malcolm Black
Mill Superintendent
Wright-Hargreaves Mines, Ltd.,
Kirkland Lake, Ont.

SOLUTION for precipitation consists entirely of Genter thickener effluent. There is a separate effluent receiver for each thickener. Three 4-in. Babcock and Wilcox centrifugal pumps of 625 g.p.m., working against a 100-ft. head (one acting as a spare for either receiver), pump 4,000 tons of solution per day to the clarifying presses, and the remainder to grinding solution storage. These pumps are direct-driven at 1,740 r.p.m. by 25-hp. motors. In addition, a pump of similar make and capacity is placed in the line feeding the clarifiers, as a booster. There are three 42-in., 30-frame Merrill sluicing clarifying presses, one of which is generally in reserve and is cut in when one of the others is being sluiced. The plates are covered with 10-oz. duck. One of the penalties imposed by the use of Genter thickeners in this mill is that occasionally, and without warning, one or more tube socks will tear, and allow an excessive amount of slime to reach the clarifying presses, thus necessitating frequent sluicing. When the effluent becomes turbid, a visual indicator warns the operator of that condition. Unfortunately, it takes some minutes to locate the offending header. Under normal conditions the presses are sluiced twice per shift. Canvas life is about one month. During this time it is treated in place with 2 per cent HCl.

The clarified solution passes directly to an 8x5-ft. constant-level tank placed under the presses. It then flows through the Crowe de-aerating tower and to the pump supplying the precipitation presses. A float placed in the constant-level tank controls a valve in the line feeding the clarifying presses, so that the amount of solution clarified is automatically controlled by the amount precipitated. With this system, a large storage tank for pregnant solution is not necessary.

Zinc dust is fed at the rate of about ½ oz. per ton of solution to the emulsifying cone by means of a spiral feeder, a small stream of barren solution being used for emulsifying. It is then pumped into the line feeding the presses by means of a 1-in. centrifugal pump, directly connected to a 2-hp. G.E. induction motor running at 3,490 r.p.m., full load. The pump and motor form an integral unit.

There are three 42-in. square Perrin precipitation presses, two of which are in continuous operation, the third serving as a spare. The solution is measured by a 6-in. Venturi meter having a 3-in. orifice and placed at a point ahead of that where the zinc is added.

Vacuum for de-aeration of solution is maintained at about 27½ in. of mercury by a Rand Type-15 pump.

Under normal conditions the Venturi meter is correct to about 0.5 per cent either way. On several occasions, however, it has been found to get out of adjustment somewhat beyond this limit. Although it is provided with oil seals, cyanide solution occasionally reaches and dissolves some of the mercury in the float chamber, thus causing inaccuracy. In a case of this kind, mercury is added to bring the level to the normal position.

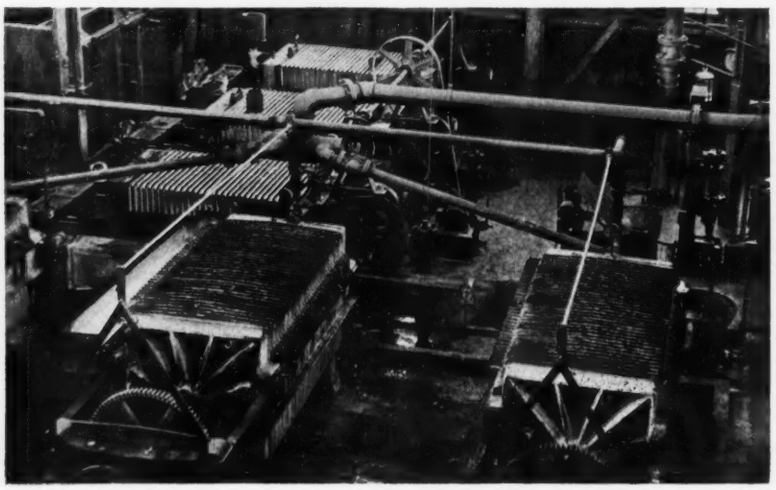
The meter is calibrated twice a month by passing about 150 tons of meter-measured solution (press tailings) to a calibrating tank of known volume. The tank is of steel, 20 ft. long and 6 ft. wide outside. A longitudinal partition divides it into two compartments of equal volume, each holding 5.58 tons of solution. Each compartment is equipped with a large release valve to assure rapid emptying. The solution (press tailings), already measured by the Venturi meter, is fed to each side alternately by a movable hopper. The release valves are large enough to permit one side to be discharged some time before the other is filled.

Press tailings are aerated by pumping through a tank similar in design to that of the Crowe de-aerating tower, the difference being that air at 25-lb. pressure is added. The float for controlling the solution level is placed in an external chamber and connected to the tank by two 2-in. pipes, one at the top and the other at the bottom of the valve chamber. The float rod extends through a packed gland. By means of levers the discharge valve is automatically operated to maintain a constant level in the tank.

The amount of air used is very small, but the efficiency in aerating the solution is remarkably high. Oxygen determinations on the aerated solution, made by the Weinig and Bowen method, indicate complete saturation.

The Clean-Up and Refining—The presses are cleaned every seven to eight days or four times per month.

On the clarification and precipitation floor. The solution for precipitation consists entirely of Genter thickener effluent



Each period begins and ends at 7 a.m., so that there is no overlapping. The plates are covered with 10-oz. duck and one layer of cotton sheeting, which is removed and burned in a specially designed stove at each clean-up. The duck lasts for several months and is then burned. Precipitate averaging about 900 lb. (wet weight) is transferred to the refinery in reinforced galvanized wash tube. After weighing and sampling, it is dumped into a steel mixing box and the following flux added (based on dry weight).

	%		%
Borax glass	28	Lime	7
Nitre	30	Soda	5
Silica sand	17	Fe_2O_3	7
Salt	10		

The moisture content of the precipitate is generally about 30 per cent save when power interruptions have caused the cake to drop to the bottom of the frames where it is difficult to pass enough air through to dry it to that extent. When it is not too wet, the flux and precipitate is first given a rough mix with shovels, then put through a screen with ½-in. openings. We find this procedure produces a much finer grade of bullion than obtained without screening. A typical precipitate analysis is as follows:

	%		%
Au	43.2	Zn	7.62
Ag	6.38	Pb	0.44
Cu	12.26	Insol.	15.00
Te	3.08		

On clean-up days the furnaces are started at 7 a.m. and have attained maximum heat by the time the first batch of precipitate comes from the presses. Preheating not only hastens fusion but adds greatly to the life of the lining. Each furnace is charged to about the center line, and as the charge recedes, more is put in until approximately 300 lb. (precipitate plus flux) has been added. This is allowed to fuse completely and is then poured into conical slag pots. The operation

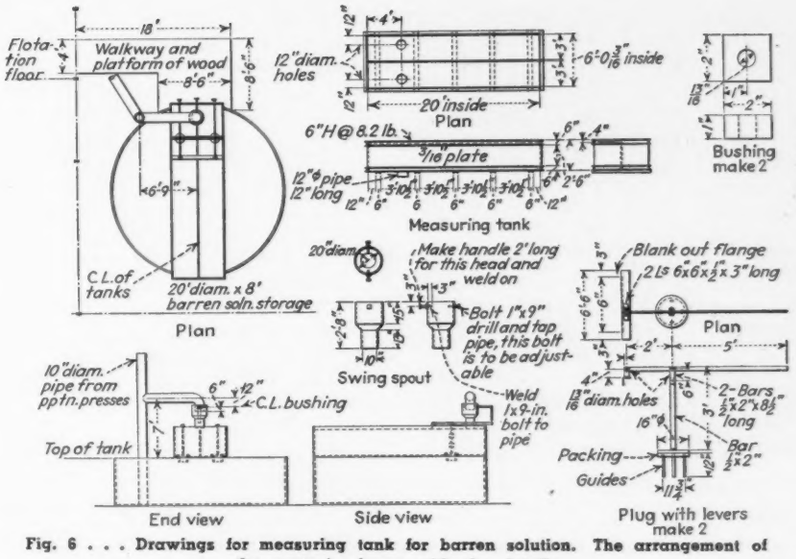


Fig. 6 . . . Drawings for measuring tank for barren solution. The arrangement of the parts is shown with the details

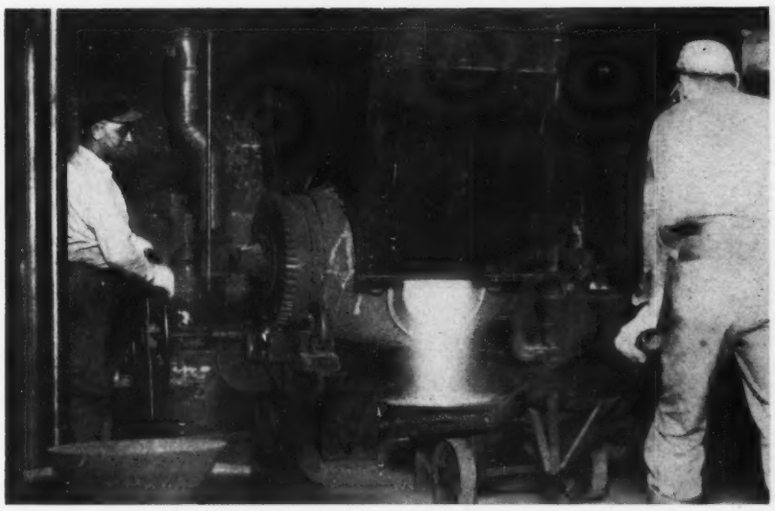
is repeated until all the precipitate has been melted. The resulting buttons are then put back in the furnace with a little borax and poured into bars. While the bars are still hot, they are plunged into a bath of weak nitric acid, then brushed vigorously with wire brushes to remove the surface film. They are then sampled by drilling two holes halfway through, one at a top corner and the other at the diagonally opposite bottom corner. Total fineness of bullion is 910 to 960. The ratio of gold to silver is about 6 to 1. Rate of melting, including the remelting of the buttons, is equal to about 100 lb. of precipitate per hour, when using two furnaces. The furnaces are of the Monarch-Rockwell type and are fired with fuel oil. Air at 12 oz. pressure is supplied by a Sheldon fan blower, directly connected to a 2-hp. motor and having a capacity of 1,000 cu.ft. of air. Both air and oil are preheated by passing the feed pipes through the furnace hoods. A spare furnace shell with new, dried lining, ready to use is always kept on hand. The lining in use is P.B. sillimanite supplied by Canadian Refractories, Montreal. The mix reaches us in 200-lb. air-tight steel containers and has the proper moisture (about 7 per cent) for ramming. About 1,400 lb. is required for each furnace.

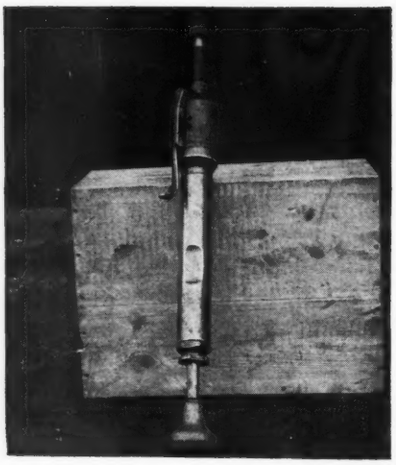
The average life is a little better than 200 furnace-hours as against approximately 130 hours for a commercial silicon-carbide lining formerly used. When the latter was in use, a hard-to-treat matte invariably formed on top of the bullion, due possibly to the reducing action of the free carbon in the lining. The matte generally consisted of the following constituents: tellurium, 40 per cent; gold, 20; silver, 20; and copper, 20. Using the same type of flux, the sillimanite lining produces a bullion of better grade and no matte whatsoever. The slag, however, is generally somewhat higher in value than that produced when the silicon carbide was in use.

As with most ramming mixes, the method of ramming used is of considerable importance to the life of the lining. In preparing to ram a new lining at this plant, the spare shell is placed on wooden supports and opened out. The bottom of each half-shell is rammed to the full thickness of the lining and shaped to conform with the bottom of the template. The latter is then inserted and bolted into position for ramming the balance. If the template is first put in place, it is difficult to reach under it with the ramming tool. Consequently the lining is soft and porous at that point and will peel badly when put in operation.

Pneumatic sand-ramming tools, with trigger control and having a 7-in. stroke, are used. They make a much

Pouring bullion in the Wright-Hargreaves refinery. The hood prevents fumes from escaping into the building





Pneumatic bench hammer used for ramming furnace lining

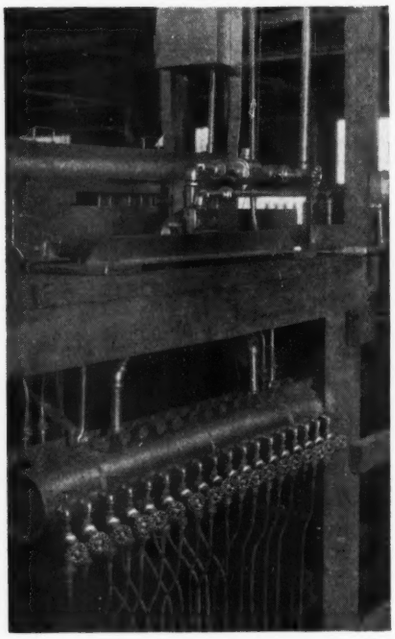
denser job than by hand. We find it best to break up the surface between courses so that the finished lining will be practically monolithic and not in the form of layers.

When the job is completed, an electric heating element drawing about 100 watts is placed inside and left there until the furnace is put in operation. This may be anywhere from two to three months. In any case, the lining is always bone-dry before using.

Mill sampling—All important mill pulps, including several grades of concentrate, are sampled every 15 minutes by means of a wedge-shaped cutter which passes across the stream. The cutter is suspended on a light framework which runs on ball-bearing wheels. The track is made from 1-in. angle iron. Being attached to a piston, the frame, is pushed out and in, alternately, every 15 minutes by air pressure. The cylinder is made from 2-in. pipe, with a port at each end (see photo). Ports are connected to a master timing apparatus by means of $\frac{1}{4}$-in. copper tubing. The master timer consists of a timing mechanism, operated by a Telechron motor, a Geco electric sampler, a four-way valve, and a master air cylinder.

The conventional method is to place an electric sampling unit at each station, the cutter being attached to the movable arm. At this plant, we use only one electric unit. The moving arm operates a four-way valve having the following connections: air feed, exhaust, and one to each side of the master cylinder. The latter has a partition in the center, and in effect is actually two cylinders, the air being admitted first to one, then the other. The exhaust port in the four-way valve allows spent air to escape. A copper tube is led from each compartment of this cylinder to the front and back ports of each station cylinder. A valve placed in the main air line ahead of the master apparatus controls the speed at which the cutters cross the pulp stream.

In sampling press heads and press tailings at this plant, use is made of the well-known automatic-siphon flush tank. The inverted U-tube and other piping on the commercial article are made from copper or brass. Obviously this would not be suitable for cyanide work. Those in use here are of iron and were made on the property. In operation the tank is fed continuously by a $\frac{3}{8}$-in. pipe tapped into the main solution line. When the tank fills to the top of the U-tube, the siphon is automatically put in operation, and the tank quickly emptied. In the discharge line (preferably the horizontal portion) a nipple



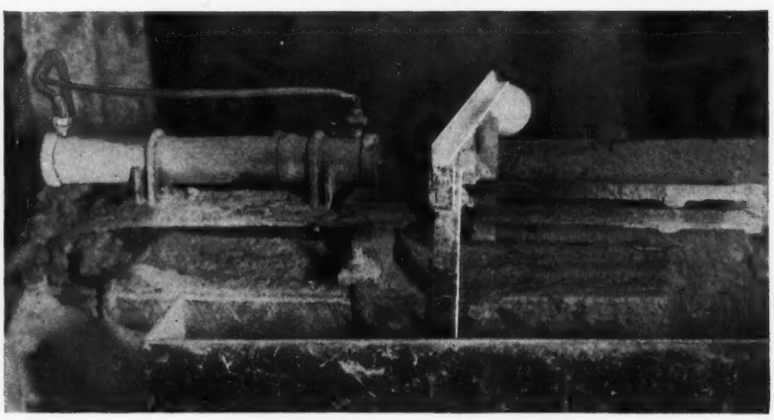
The master sampling apparatus. Above is the timing device and the Geco sampling unit controlling the air. Below is the air cylinder supplying individual sampling stations

is inserted for delivery of the final sample, which is caught with each discharge cycle of the flush tank. An ordinary pipe nipple is much too large unless the hole can be partially blocked. We use a piece of round iron through which a 1/16-in. hole is drilled. The nipple should be long enough so that with a rubber stopper fitted over it, a portion should protrude past the end of the stopper. The stopper fits into the neck of a 2-gal. bottle supported by a steel cage. Volume of sample may be controlled by the distance the nipple is inserted in the discharge line. A similar scheme is used for sampling press tailings, but with the addition of a sample safe (see photo).

The flush-tank discharge line enters the safe at one end near the top and comes out at the other end. The excess solution, as in the former case, discharges at a point below the sampling apparatus. Three Winchester bottles are placed in the safe each morning, one for each shift, and the safe locked. The sample nipple is inside the safe and directly above the "A" shift Winchester, which is provided with a funnel to catch the sample. For "B" and "C" shifts a drip catcher in the form of a small box, supported on slides, is pushed into position by means of rods which extend through the side of the safe. The box falls into a notch made in the slides. It cannot be removed from this position except when the safe is open. A rubber tube conveys the sample from the catcher to the respective Winchesters. Should high press tailings occur during any shift, the evidence cannot be destroyed, as would be possible without the safe. The samples are also protected against accidental salting.

Tailings disposal—Mill tailings are pumped into a steel stand-pipe 30-in. in diameter by about 89 ft. high above the ground level. A 12-in wood-stave pipe connected near the bottom conveys the tailings to a disposal site about two miles from the mill. The stand-pipe is fed by a 5x5-in. Allis-Chalmers S.R.L. pump driven at 1175 r.p.m. through a V-belt drive, by a 35-hp. motor. Feed enters the stand pipe about 46 ft. above the center line

One of the sampling stations controlled by the master timing apparatus. Note air feed pipes at end of cylinder



of the tailings pipe. This is slightly above the normal pulp level. The chief advantage of the stand pipe is that the tailings line is always kept full. In cases of power interruptions in the winter the stand pipe is fed with water from the town supply system to prevent the line from freezing. The velocity in the pipe line is about 1.6 f.p.s. The present tailings line has been in operation for more than four years without showing any sign of lime deposition. This is due to the fact that most of the residual lime is precipitated as $CaCO_3$ ahead of flotation by the addition of soda ash.

Power—Power is purchased from the Northern Ontario power system, which includes several 60-cycle plants at various points in northern Ontario. It is delivered at 2,220 volts, 60 cycles, and stepped down to 550 volts by our own transformers and to 110 volts for lighting. The mill power is fed to a central control room within the mill, wherein is located switch gear for each motor. Pushbutton stations are placed conveniently near the motors. Connected mill-load amounts to approximately 2,830 hp. The average horsepower load for the fiscal year 1937-38 was 2,628, at an average cost of 47.11 per horsepower. Average power consumption was 2.2 hp. per ton milled.

In the event of power interruptions, which are numerous during the summer months, an auxiliary plant in the compressor house is put into service to keep agitators, classifiers, and other equipment in motion. The plant consists of two 160-hp. Sterling gas engines, directed-connected to two G. E. 125-kva. 550-volt, 60-cycle alternators.

In the event of the normal source of power failing, a contactor in the control room drops out and closes the operating circuit of another contactor, so that, when the auxiliary power is made available, the latter contactor immediately picks up, energizing the auxiliary section of the mill bus. The same automatic control applies to the lighting transformers in the control room, the two contactors in the 550-volt primary circuit closing the auxiliary power on the transformers as soon as it is available.

Character of Ore Milled—In the Kirkland Lake area ore occurs in a varied assemblage of rocks of Temiskaming and Algoman age, such as graywacke, conglomerates and tuffs, syenite porphyry, syenite, and lamprophyre. In the Wright-Hargreaves mine, in particular, the host rock to date has been entirely syenite porphyry. Incidentally, this accounts for the fact that thickening is not such a problem in this mill, as at others in the district where the host rock contains a large percentage of graywacke. Briefly, the ore at this mine consists mostly of mineralized altered syenite porphyry with a small proportion of

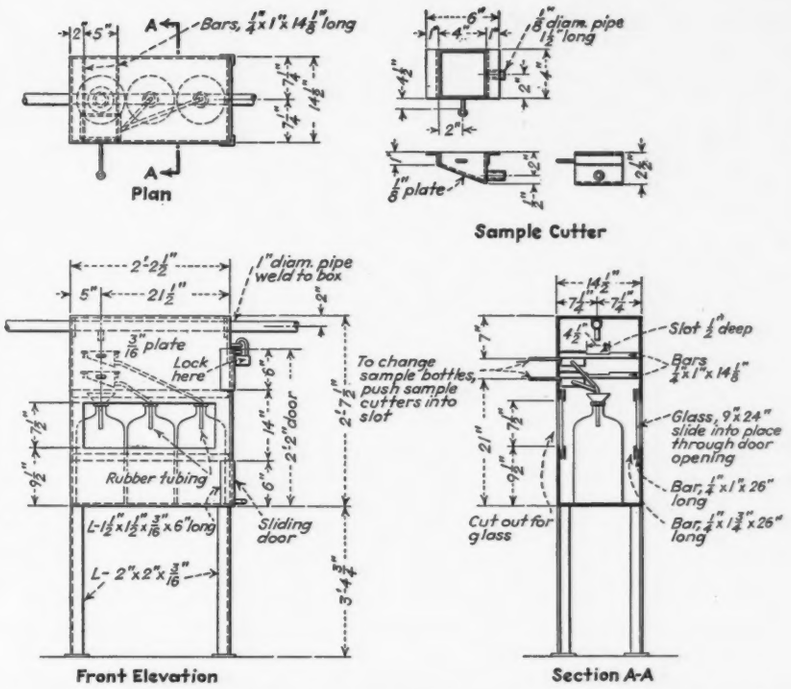


Fig. 7 . . . Construction details of the sample safe—a steel box for press tail samples. By this means samples cannot be tampered with or accidentally salted

vein quartz and still less calcite. The chief alteration of the porphyry consists of the development of carbonate of lime, magnesium, and iron replacing the feldspar and ferro-magnesium minerals. The vein mineralization comprises the following: pyrite, chalcopyrite, gold, gold-bearing and base tellurides, molybdenite, galena, and sphalerite. A recent analysis of the ore which is fairly representative of the mill feed is given in Table VIII.

Table VIII—Analysis of Ore

Au, oz. per ton	0.66	MoS_2	Trace
Ag, % per ton	0.10	SiO_2, %	66.23
Fe, %	2.58	Al_2O_3, %	13.31
Pb, %	0.014	CaO, %	3.64
Cu, %	0.008	MgO	1.68
Te,	Trace	Na_2OK_2O, %	7.06
S, %	0.70	CO_2, %	3.10

Milling costs for the year 1937 were $1.159 per ton milled, the items entering into this figure are given in Table IX.

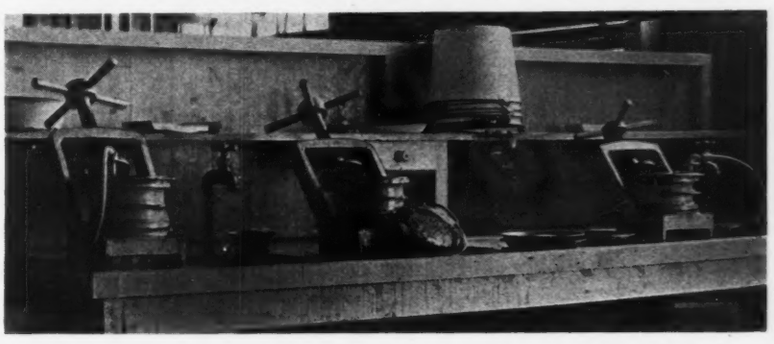
Table IX—Milling Costs, 1937

Crushing	$0.105	Superintendence	0.025
Ball mills	0.231	Repairs, general	0.008
Tube mills	0.221	Experimentation	0.004
Filtering	0.104	Flotation	0.104
Thickening	0.066	Spills—sump	0.003
Agitation	0.038	Tailings disposal	0.035
Precipitation	0.033	Reagents	0.104
Assaying and sampling	0.043		
Refining	0.016		
Lighting	0.011		
Heating	0.011		

Crushing plant—The crushing plant is under the supervision of the master mechanic. It operates on two 8-hour shifts. Seven men are employed, four on the first shift and three on the second. Removal of tramp wood occupies the full time of one man on each shift. Heavy repairs are done mostly on day shift by the mechanical crew.

The mill crew for the past few years have been on a six-day week basis. There are occasions, of course, when, due to certain circumstances, one or several operators may be required to work seven days or more without a day off. When the scheme of working six days a week was first introduced, the company raised the per-hour rate

Sample bench showing pressure dryers. Pulp samples are dewatered here



Zinc Mining Active In Eastern Area

New York, New Jersey, and Virginia properties continued their operations in 1938, producing only a tenth less than in year preceding

IN THE eastern region of the United States in 1938, the combined output of the two zinc-producing mines in New York, the two in New Jersey, and the one mine in Virginia amounted to 138,870 net tons of recoverable zinc in ore, according to Russell B. Paul, assistant general manager of mines, New Jersey Zinc Company, in a paper presented at the recent annual meeting of the American Zinc Institute in St. Louis. This combined production was 15,380 tons, or 10 per cent less than the 1937 production of 154,250 tons of recoverable zinc. Poor demand and low metal prices are given as the cause. The 1938 output given is approximately 27 per cent of the United States production in the same period.

In the first quarter of 1938 the St. Joseph Lead Company operated the Balmat and Edwards mines, in St. Lawrence County, N. Y., 6 days, of 7 hours each, per week. In the second and third quarters, operation was reduced to 5 days per week. In the fourth quarter the 6-day schedule was followed. The Edwards mine milled 105,049 tons of ore, producing 18,429 tons of zinc concentrates, running 58.72 per cent zinc. The Balmat milled 280,579 tons of ore, yielding 39,854 tons of zinc concentrates (56.45 per cent zinc), 3,301 tons of lead concentrates (61.81 per cent lead) and 71,425 tons of iron pyrite concentrates (49.72 per cent sulphur). The Edwards mill treated an average of 370 tons of ore per day and the Balmat mill 1,013 tons daily.

The bulk of the Edwards ore came from 1,700-ft. level, the 1,500-ft. level also contributing. Development work on the 1,900-ft. level has proved that the ore veins persist in grade and size to that depth. The shaft was deepened to 2,100 ft. The major part of the Balmat production came from the 500- and 700-ft. levels, development indicating satisfactory extension of the orebody on the 900-ft. level. The shaft remains bottomed at 1,300 ft.

The New Jersey Zinc Company operated its two mines in New Jersey continuously in 1938 but decreased the total operating time. The 1938 production of recoverable zinc in ore from both mines amounted to 86,280 tons, 12.7 per cent less than in 1937. For several years the company has limited employees' weekly working schedule to a maximum of 40 hours, 5 8-hour days. Actual working time in 1938 averaged about 90 per cent of this schedule.

During 1938, the Bertha Mineral Company, formerly a subsidiary of New Jersey Zinc, was merged with the parent company. The property at Austinville, Va., operated continuously, producing 24,270 tons of recoverable zinc in ore, which was 560 tons more than the 1937 production of 23,710 tons. Operations at Austinville are practically continuous, the working schedule being 40 hours per week (5 days of 8 hours). The present operating rates at Austinville and at the New Jersey mines are practically the same as in 1938.

Wright-Hargreaves Improves Its Milling Practice—III (concluded)

(*Continued from page* 45)

to compensate partially for the reduced earning power. Nevertheless, the scheme met some disfavor from a number of men who wished to continue on the seven-day basis. The resentment, however, lasted only until they became accustomed to a day off each week. The general feeling now is definitely in favor of the six-day week, chiefly because the men realize its beneficial effect on their health. The crew excluding the mill superintendent comprises the following:

1 Assistant mill superintendent
1 Statistics and research man
3 Shift bosses
3 Solution men
3 Ball-mill operators
3 Filter operators
1 Filter maintenance man (day shift only)
3 Genter operators
1 Sampler
1 Refinery man
2 Repair men
2 Repair helpers
1 Laboratory helper
3 Relief operators
1 Mill laborer

The duties of the solution men include looking after the flotation plant, among others. The filter-maintenance man does all the acid-treating, the scrubbing, and the repairing of broken wires. The sampler prepares all the pulp samples and delivers them to the assay office. He also attends to the mixing of flotation oils and reagents and keeps the feeders replenished. The refinery man, in addition to his work in the refinery, cuts the canvas for the clarifying and precipitation presses and helps with general mill repairs.

In addition to looking after general maintenance, the repair crew clean and dress the presses and supply help in the refinery. One of the repair men acts in the capacity of shift boss three days per week. The three spare operators relieve on the filters, thickeners, ball mills, and solutions.

Acknowledgments—I wish to thank the managing director, M. W. Summerhayes, and his fellow directors for permission to write this article. I also wish to acknowledge with thanks the help received from V. C. Lindsay and S. R. Sanderson, of the mill staff, W. Smith, master mechanic, Percy Bennett, chief electrician, and H. Farah, construction engineer.

Since this article was prepared, Mr. Black advises, changes have been made in the procedure followed to keep the pulp from building up in the agitator, which was described at the bottom of page 40 and the top of page 41, in the April, 1939, issue. The new procedure is explained in the following:

"Pulp at such density and fineness will readily build on the sides of the agitator tank unless some preventive means is used. At the original rake speed of 5 r.p.m. we had considerable trouble from this condition. We tried additional low-pressure air fed through drop pipes from an annular pipe running around the top of the machine. This kept the pulp in violent agitation and in a measure helped prevent building. When one or more of the pipes became plugged, however, building would begin at that point and rapidly extend around the tank. The drop pipes then acted as a foundation for the pulp to cling to. We next adopted a scheme which had been found successful at a neighboring mine. A paddle, made from two pieces of 8-in. channel, is clamped to the air-lift column at a point about midway down, and extends to within 12 in. from the side of the tank. The rake speed was increased to 6.25 r.p.m. The swirling motion of the pulp at this speed seems sufficient to keep the sides of the tank scoured and definitely prevents building. The 5-hp. motor formerly used for driving both agitators had to be replaced with one of 10 hp. The increase of power is more than compensated by the saving in air."

Mr. Black states further that in preparing the data for Table V, page 39, April issue, on Hydroseal pump operation, an error was made. In the last line, the suction side bell liner is given a life of 365 days. This should read 36 days. The cost per day for this part should read $0.616, cost per ton milled 0.0514c., and cost per dry ton pumped 0.0171c. The totals are thus: cost per day $3.983, cost per ton milled 0.3319c. and cost per dry ton pumped 0.1106c.

Furnace Roofs and Thermal Losses

Conclusions as to the relationship between them

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IN THE metallurgical field great lack of available information is apparent with regard to the thermal losses due to the various types of construction of furnace roofs. In many instances the "custom of the trade" has been followed without proper knowledge of the effect of such installation. In others, the thickness of the roof has been increased solely because such a roof may last longer and give increased production before repairs become necessary. Although the latter may be advantageous from the viewpoint of lessening roof repairs and of saving fuel through fewer heatings of a cold furnace, yet in the long run, the effect of such a change may be offset by such increased thermal losses that it is uneconomical.

Insulation of furnace roofs is being investigated seriously just now by competent engineers. Nevertheless many operators may make such installations without realizing that though in some installations it is beneficial, in others it is detrimental. In the following, thermal losses in various types of furnace roofs are considered. The conclusions may be of advantage to those interested in the installation and operation of the many types of furnaces now available.

Three types of roofs are in general use: clay, silica, and magnesite. Most installations are uninsulated, though, as pointed out, the use of insulation is increasing. In this discussion the interior temperature of the furnace has been taken as 2,600 deg. F. and the outside air temperature as 80 deg. F. All B.t.u. data refer to the thermal loss per hour per square foot of roof area, unless otherwise specified. It will be assumed also that roofs are allowed to wear to a thickness of 4½ in. before being replaced.

The thermal loss through a roof is the sum of the combined convection and radiation losses. The former is affected by the temperature difference between the interior and exterior of the brick; the latter depends on the temperature level. It follows that with low external brick temperature the loss by convection is the major source, whereas at higher temperatures radiation is the controlling factor, and if a brick is allowed to become very thin the radiation loss is excessively large and the convection loss is of minor importance.

The radiation loss, assuming an emissivity of 80 per cent, is calculated from the formula

$$0.13\left[\left(\frac{T_1}{100}\right)^4-\left(\frac{T}{100}\right)^4\right]$$

where T_1 and T are the absolute temperatures of the roof and the surrounding objects. Though numerous formulas have been given for the convection loss, the following appears to satisfy existing conditions:

$$0.25\ (T_1-T)^{\frac{4}{3}}$$

As the conductivity through the brick equals the combined convection and radiation losses, the external temperature of the brick may be approximated by the use of the following thermal conductivities expressed in B.t.u.'s per hour per sq.ft., per inch thickness per degree F., difference in temperature.

Clay	$5.0 + 0.0028t$
Silica	$6.0 + 0.0033t$
Magnesite	$39.5 - 0.008t$
Vermiculite	$0.65 + 0.0006t$

Table I gives the average thermal losses due to radiation and convection that may be expected from various types and thicknesses of roof brick.

From these figures it is apparent that the thermal loss is lowest with clay brick and that the use of magnesite brick more than doubles the loss incurred when using clay brick. It shows also that with respect to radiation and conduction, the thicker the brick the less the thermal loss.

Although the average losses are given in the table, it may be interesting to show the great increase in loss due to decrease in thickness of brick when these are allowed to wear to 4½ in.

A 9-in. silica roof will have an original thermal loss of 2,560 B.t.u., but when the roof has worn to 4½ in., this increases to 4,820 B.t.u., an increase of 88 per cent. This corresponds roughly to an additional consumption of 4 lb. of coal per day per square foot of roof area. When a 12-in. roof has worn to 4½ in., the thermal loss increases 137 per cent, and for a 15-in. roof the increase becomes 195 per cent over that for a roof of full thickness. This indicates that there may be little economy in allowing a roof to get too thin before replacement, in an effort to maintain production, and in many operations it will be found decidedly economical to replace roofs long before they have been reduced to a thickness of 4½ in.

In addition to the loss by radiation and convection there is another loss not generally recognized. Every furnace roof has a definite heat capacity, and although a high capacity is extremely desirable with continuous operation, inasmuch as it acts as a balance wheel in maintaining even temperature in the furnace, yet with intermittent working where the furnace is cooled to a black heat during charging, a high capacity will result in serious thermal losses. In calculating the heat capacities the mean specific heats of the various materials have been taken as:

Clay	$0.192 + .000032t$
Silica	$0.183 + .000040t$
Magnesite	$0.208 + .000038t$

In Table II the losses due to allowing the furnace to cool to a temperature of 900 deg. F. are shown.

The silica brick have slightly less heat capacity than the clay brick, whereas the magnesite brick, owing to their greater weight, have a heat capacity of nearly twice that of the other brick. With a new roof these losses will be increased due to the greater thickness and will, of course, decrease as the roof gets below the average thickness.

Combining the data of Tables I and II, we obtain the figures given in Table III, showing the total thermal losses for a furnace handling from one to four productions per day.

From these figures it is seen that the clay brick are the most economical and also that with any kind of brick the use of the thicker roof is increasingly uneconomical as the work of the furnace becomes more intermittent. The losses when using magnesite brick are twice those incurred when using

Table I—Average Thermal Losses Due to Radiation and Convection

Original thickness of brick	9 in.	12 in.	15 in.
Average thickness of brick	6.75 in.	8.25 in.	9.75 in.
B.t.u. loss per sq.ft. per hour			
Clay	2,950	2,750	2,570
Silica	3,690	3,425	3,225
Magnesite	6,835	6,205	5,910

Table II—Losses Due to Cooling

Original thickness of roof	9 in.	12 in.	15 in.
Average thickness of roof	6.75 in.	8.25 in.	9.75 in.
B.t.u. loss per sq.ft. of roof area			
Clay	14,830	17,350	19,635
Silica	14,440	16,100	18,050
Magnesite	24,950	29,800	34,200

clay brick. Losses shown are, of course, relative, as most furnaces do not cool to such an extent when recharging, and the shorter the charging period the nearer the furnace approaches continuous operation. They do, however, indicate the possibility of serious loss from this source, which is sometimes realized.

Processes there are, of course, where it is not possible to use clay brick, and there are others that do not permit the use of silica brick. In such circumstances the type of brick suited to the process must be used even though such use results in higher thermal losses.

In some operations there is a disadvantage in using thicker brick, because the temperature drop through the brick is quite low for the first few inches, the distance increasing with the thickness of the brick. Magnesite will carry a higher temperature further into the brick than will either clay or silica. This high interior temperature greatly facilitates the deep penetration of the brick by metal and slag and enhances any reaction that may occur between the brick and corrosive slags and dusts. The latter may become so pronounced as to shorten the life of the brick materially and require the use of a thinner roof.

The high thermal losses shown due to radiation and conduction, which in the 12-in. brick are equivalent to a coal consumption of 5.1 lb., 6.3 lb., and 11.4 lb. per day per square foot of roof area, for clay, silica, and magnesite respectively, have brought to the foreground the problem of satisfactory insulation for roofs.

Assuming an insulating layer of 3 in. of a material having a thermal conductivity similar to that of vermiculite, we find there will be a great reduction in the losses by radiation and convection, but the decreased loss will result in a higher average temperature of the brick under the covering of insulation. This may increase the heat capacity to such an extent that it may offset the saving in the loss by radiation and convection. In clay brick installations, the increase in the average temperature of the brick may bring it closely to the point at which the brick will soften under load. The use of insulation with clay brick is of doubtful value unless it is applied with special brick, or with working conditions employing temperatures well below that which we have been considering, or with a composite type of roof.

The high average brick temperature resulting from the use of insulation greatly magnifies the disadvantages mentioned of increased metal and slag penetration and of attack on the brick by corrosive slags and dusts, so that in many operations the use of insulating brick may be impracticable. Metal penetration may extend through the entire brick, involving a heavy expense in treatment of the worn-out brickwork, whereas with an uninsulated roof there is usually quite a layer of clean brick that can be cobbed. Another point is that, with such high average brick temperatures, it may not be possible to use certain types of insulating material, as they will not withstand the temperatures without serious loss in insulating efficiency. Under such conditions it becomes necessary to install a middle layer of material of lower insulating capacity between the roof brick and the outer high insulating layer. This composite type of roof is being increasingly used and will generally have a lower thermal capacity.

Table III—Total Thermal Losses

Original thickness of roof	9 in.	12 in.	15 in.
Average thickness of roof	6.75 in.	8.25 in.	9.75 in.
B.t.u. loss per day per sq.ft. of roof area			
Clay			
1 charge per day	85,630	83,350	81,225
2 charge per day	100,460	100,700	100,850
3 charge per day	115,290	118,050	120,475
4 charge per day	130,120	135,400	140,100
Silica			
1 charge per day	103,000	98,300	95,450
2 charge per day	117,440	114,400	113,500
3 charge per day	131,880	130,500	131,550
4 charge per day	146,320	146,600	149,600
Magnesite			
1 charge per day	188,990	178,720	176,040
2 charge per day	213,940	208,520	210,240
3 charge per day	238,890	238,320	244,440
4 charge per day	263,840	268,120	278,640

Table IV—Radiation and Convection Losses Due to Insulated Roof

Original thickness of roof	9 in.	12 in.	15 in.
Average thickness of roof	6.75 in.	8.25 in.	9.75 in.
B.t.u. loss per sq.ft. per hour			
Silica	980	910	875
Magnesite	1,010	985	960

Table V—Loss in B.t.u.'s on Cooling Due to Higher Average Temperature

Original thickness of roof	9 in.	12 in.	15 in.
Average thickness of roof	6.75 in.	8.25 in.	9.75 in.
B.t.u. loss per day per sq.ft. of roof area			
Silica			
1 charge per day	49,000	53,000	57,700
2 charge per day	74,500	84,150	94,400
3 charge per day	100,000	115,300	131,100
4 charge per day	123,500	146,450	167,800
Magnesite			
1 charge per day	69,420	78,740	88,000
2 charge per day	114,600	133,840	153,000
3 charge per day	159,780	188,940	218,000
4 charge per day	204,960	244,040	283,000

With the insulated roof the resulting radiation and convection losses with silica and magnesite brick will be reduced to approximately those shown in Table IV.

The higher average temperature greatly increases the thermal capacity. Table V shows the loss from this source when the furnace is allowed to cool.

Comparing the data in Table V with those of Table IV, the great advantage of insulation is apparent, though the disadvantage of thicker roofs is again apparent when the furnace is engaged in intermittent operation.

In conclusion, it may be pointed out that for continuous operation a high heat capacity is desirable and this calls for thick brick preferably backed with good insulating material, provided the corrosive action of slags and dusts is not aggravated to an uneconomical point. Intermittent furnaces should be constructed with low heat capacity, which requires thinner brick backed with composite insulation. This type of construction requires less fuel to bring to a desired temperature and loses less heat when cooling.

Molybdenum at New Peak

THE production of molybdenum in the United States again set a new peak in 1938 with an increase of 13 per cent over the record output of 1937. Shipments, however, were 15 per cent less. Domestic production amounted to 36,157 short tons of concentrates carrying 33,297,000 lb. of metallic molybdenum. The output consisted of 31,961 tons of molybdenite-bearing concentrates, averaging 85.56 per cent (54,691,000 lb.) of molybdenum sulphide (MoS_2), containing 32,814,600 lb. of metallic molybdenum; and 4,196 tons of wulfenite-bearing concentrates, averaging 8.62 per cent (723,600 lb.) of molybdenum trioxide (MoO_3), containing 482,400 lb. of metallic molybdenum.

Concentrates shipped from mines in 1938 contained 25,727,000 lb. of molybdenum with an estimated value of $17,977,000, compared with 30,122,000 lb., with an estimated value of $20,571,000, in 1937.

About 85 per cent of the domestic output of molybdenum came from the Climax Molybdenum Company in Colorado. Production of molybdenum-bearing ores was also reported from Arizona, Idaho, New Mexico, Utah, and Washington. The Arizona Molybdenum Corporation at Copper Creek, Pinal County, was the largest producer in Arizona; the Mammoth-St. Anthony, Ltd., near Mammoth, Pinal County, produced concentrates recovered from wulfenite bearing ore, and the Miami Copper Company recovered molybdenite concentrate from copper ore. In New Mexico the Molybdenum Corporation of America continued production from its mine near Questa, and the Nevada Consolidated Copper Corporation recovered molybdenite concentrates from copper ore from Grant County. Output in Utah came from the treatment of copper ores by Utah Copper. A small output of concentrate (no shipments) was made in Idaho. A small production of molybdenite concentrates was turned out by Deertail Monitor Mines Company in Stevens County, Wash.

Gold in Peru

Current conditions suggest opportunities for those with capital to invest

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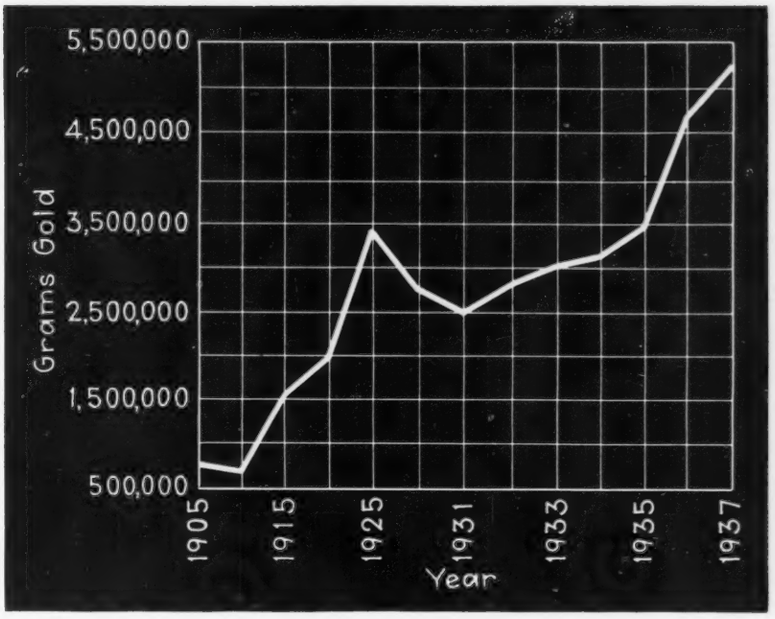


PERU today offers a virgin field for research in many phases of the mining industry. The information here presented is based on general notes taken from numerous works covering the natural resources of the country and on personal observations made during the last few years. I hope it will give those who may be interested in the country an idea of current conditions there, especially as they relate to gold mining.

Generally speaking, Peru may be divided into three distinct belts, all with a northwest-southeast trend. The western or coastal belt lying along the Pacific Ocean is an arid desert with low rolling hills. It is comparatively narrow and is cut by swift mountain streams which empty into the sea. A number of gold mines are in operation or under development currently in the southern part of the belt. The central belt is mountainous and contains the low foothills on both the eastern and western slopes of the main Andean ranges. Here, gold is found associated with other minerals and usually constitutes a by-product. There are some lode mines of auriferous quartz veins, but only a few are worked or prospected. This area is bordered by high ranges, with a high range following the main axis near the center. The plateau country is 13,000 to 15,000 ft. above sea level. The eastern belt consists mainly of lowlands, where both placer and lode mines are found. Prospecting, however, is difficult, owing to intense tropical vegetation.

Peru is traversed by three main mountain ranges—namely, the Cordillera Occidental or Western Range, Cordillera Central or White Range, and the Cordillera Oriental or Eastern Range. They join in the Department of Junin, thereby forming a large basin in which lies Lake Junin. From here the main rivers draining the central and eastern belts start to flow north and south. The Mantaro River, the main stream, flows south, then makes a turn east, followed by another turn north, forming one of the headwaters of the Amazon. Along the main axis there are many high peaks, all more than 21,000 ft. high. The snow-covered peaks in the Callejon de Huaylas, such as Huandoy, Huascaran, Putaca, Huancarhuas, or Pup-puy and Yanasinga, near Morococha, all form imposing sights. Today, these mountains, though just south of the equator, form one of the most extensive ice fields known. In many sections the peaks are of sedimentary origin; in others the invaded rocks have been eroded completely.

The oldest rocks are those of the Pre-Cambrian series occurring on the eastern side of the main range. Isolated sections are found along the younger igneous rocks. They are metamorphosed into schists, gneisses, and others. The lowest formations are the mica schists found below Tarma, Cerro de Pasco, and Huanaco. Resting on the basal formation are slates, shales, and quartzites, all of which have been highly altered. They are Silurian in age. The basal formation, which varies in size and shape, is cut by numerous dikes, intrusives, and basic rock, and because of this alteration it is difficult to determine the true character of the original rock. The Silurian slates usually are dark in color, very siliceous, and fine grained. Some sections are very micaceous.

From the evidence available, extensive faulting, folding, and regional metamorphism took place in these rocks—a phenomenon absent in the younger rock resting unconformably on these sediments.

The most important gold depositions have taken place in the old rocks. This applies in particular to the isolated regions of Eastern Peru, and as a consequence the section there promises to develop into one suitable for lode and large placer properties. Gold is also found with the younger rocks. Here, however, it is in smaller amounts, and the largest percentage is obtained from the smelting of ores, or in the concentrates produced in lead-silver-copper operations. The next period of interest is the Tertiary of volcanism. Most of the properties associated with this period are along the western belt. The country rock represents some phase of this igneous activity.

Upon the Silurian slates a thick bed of younger sediments has been deposited, consisting of conglomerates, quartzites, slates, and limestones, varying in age from early Paleozoic to late Mesozoic. Into these there has been intruded a wide range of intrusive rocks varying in composition from a syenite to basic rocks—diorites. Well-developed porphyries are seen associated with the gold veins. A good example of a syenite porphyry may be seen in the White Range in the Callejon de Huaylas. It may be called the Huascaran porphyry, as it forms one of the largest intrusions in the region, and is associated with small, irregular gold veins. Orthoclase crystals of feldspar up to 6 in. are common, along with some hornblende and mica.

The intrusives in the central belt are in the form of large stocks, with dikes radiating out from the parent mass. The eastern belt contains large batholiths, which appear to be much older than the well-defined ones that form the porphyries of the western belt. This belt contains a very large batholith which may be called the West Coast batholith. It varies in texture, but the chemical composition is much the same. Numerous phases are seen in tracing the rock for miles along the coast. One may find this intrusive from Northern Peru to south of the Ocoño River, where it is covered up by the extrusive flows found in the area around Arequipa. Usually they are light-colored and contain a large percentage of both orthoclase and plagioclase feldspars and smaller amounts of hornblende and pyroxene with mica. Quartz is noticeably absent. It ranges from a syenite porphyry to an andesite porphyry and a diorite porphyry. These intrusions were active during Tertiary times, when the Andean uplift took place.

The rivers draining Eastern Peru are the Urubamba, Apurimac, and the Mantaro. They unite in the tropical section of the country to form the Ucayali River. The Huallaga and Marañon rivers drain the northern part of the country, and form one of the main sources of the Amazon headwaters, which carry off the heavy rainfall of Eastern Peru. These rivers have a northwest-southeast path, uniting in the Department of Loreto above the town of Iquitos. Small boats may be found at many places along the streams, with most of them using Iquitos as a base. The western rivers are short and swift.

Existing conditions for transportation of supplies are favorable. Four ports, Salaverry, Chimbote, Callao, and Mollendo, are served and connected by railroad systems. From Callao one may reach Cerro de Pasco, Huancayo, and Huancavelica. Mollendo connects with Arequipa, Cuzco, and Juliaca, and with Bolivia. Chimbote opened up the Callejon de Huaylas. Other small railroads assist in the transportation of supplies and materials. The railroads mentioned serve the northern, central, and southern sections of Peru. Service is satisfactory, and rates, though they vary according to the class of materials handled, are not excessive. Contracts for monthly tonnages of concentrates and supplies are available upon arrangement.

Isolated regions may be reached in a few hours by air. Pan-American and Lufthansa Peru provide international service to the United States and Europe, and Faucett and Condor Peruana serve domestic travel. The latter company has carried a considerable amount of freight into the Pataz mining area, and regular service is maintained into the isolated sections to be opened in the near future. Faucett serves the regions along the coast at a considerable saving of time. The rates are reasonable, and in areas where overland transportation is difficult they compare favorably with those for ordinary transportation.

Table I—Approximate Distribution of Peru's Gold Output in Various Products

Product	Per Cent Gold
Blister copper	36.00
Bars, gold, silver	26.00
Precipitates	15.00
Bars, gold	10.00
Concentrates	9.00
Minerals	3.00
Mattes	1.00
	100.00

Roads are in course of construction in all parts of the country. Some serve the railroads, and others connect with the main trunk lines. Once the road program sponsored by the Government has been completed, deliveries will be speeded up materially. This is essential to the eastern sections of the country. Where a large-size project is under way, Government assistance may be procured by agreement. Products for paving are obtained from the oil fields at Talara. Here also are produced different grades of oil, including cheap fuel oil.

Peru has at all times been able to handle its internal affairs. The three basic industries of the country are agriculture (cotton, sugar, wool), mining (copper, silver, lead, zinc, vanadium, gold), and petroleum. Import taxes on mining machinery are low and in a number of cases exemptions are possible. Export taxes on gold bars amount to 5 per cent of the value.

Table II—Production of Gold in Peru (Export)

Year	Grams	Ounces
1905	776,591	24,968
1910	707,923	22,760
1915	1,590,561	51,138
1920	1,951,738	62,750
1925	3,420,378	109,968
1930	2,776,230	88,937
1931	2,494,000	80,184
1932	2,678,109	86,102
1933	3,010,111	96,776
1934	3,074,663	98,853
1935	3,451,280	110,962
1936	4,740,433	152,409
1937	5,246,193	168,670

The gold may be sold in Peru and deposited in the Banco Central de Reservo del Peru. Settlement is made at New York or London prices in foreign or local exchange. With steady employment, labor has developed the desire to work. Although he is not efficient, the native may be trained into a fairly good workman. The laws in general are satisfactory and reasonable—much more so than in other tropical countries. Cooperation is to be had, and as a rule agreeable operating conditions can be assured.

A brief summary of the mining code may be of interest. The petitioner or denouncer of the land, veins, or mine applies to the mining agent or delegate for the region in which the property lies. As there are some 70 mining districts, it is possible to make a denouncement with little or no difficulty. Any Peruvian, foreigner, groups, and companies capable of owning property are entitled to acquire mines. Individuals in the employ of the Government cannot hold any mining property while occupying office. The metal claim is a rectangle measuring 200 m. horizontally on one side and 100 m. on the other. It has an indefinite depth in the vertical direction. Only 60 claims covering one mine may be named by one indi-

Old mill of Cia. Aurifera Saramarca, near the town of Palpa. The property is on the boundary between the departments of Ayacucho and Ica

At Nazca—the plant of Cia. Aurifera Nazca, in the Department of Ica. The mine is known as the Sol de Oro

vidual at one time. The claims may be grouped without interruption forming a rectangle, the sides of which shall be in any proportion not exceeding 10 to 1. A complete description follows the request for the property. Any irregular piece of ground or part of a claim between the concessions can be denounced by the owner of the adjacent claim. For deposits of coal, petroleum, gold placers, tin, and others a square mining claim, 200x200 m. in dimensions, is used. Special concessions are available in any of these fields through legal procedures with the Government.

Taxes amount to 30 soles per year for one claim, to be made in two payments. Failure to pay taxes increases the amount until the third year, when the ground is open for denouncement. Fees are paid to the mining delegate and the mining office. Denouncements, on legal form paper, are posted and published in the newspapers. Possession is requested before the fifth month, which is granted by an engineer appointed by the Government. The aforegoing holds for any base-metal claims, and also gold claims denounced before the new gold law passed recently.

New gold denouncements are governed by the new law. A description of the property, its location, maps, and permanent reference points, all on legal paper, are deposited with the mining delegate in the area where the property is situated. A concession for exploration, ranging from 100 to 1,000 hectares, is asked for. It is for development of the property for two years, and the tax thereon is 10 centavos per hectare. If an extension is obtained, this figure increases to 30 centavos for the third year, 40 for the fourth, and 50 for the fifth year. Denouncements for exploitation are definite titles which carry 10 centavos per hectare denounced. Any denouncement for exploration must carry a payroll for six days' work per year for each hectare denounced. Denouncements for exploration carry ten days' work for each hectare denounced. There are some other details, but the foregoing will cover the essential data about the old and new type of denouncements. For taking up placer ground under the new gold law a square claim is used.

Production costs vary greatly. In many instances this is due to the methods used in the accounting system. Pay for common labor is from 1.20 to 1.50 soles per day, machine men receive 2.50 to 3.50 soles, timber men 3.00 to 4.50, and car and shovel men around 2.00. The men are mostly of the peon type. Mining costs vary from 5.00 to 8.00 soles, and milling costs from 6.00 to 9.00. Over-all costs range from 17 to 35 soles per ton under present conditions. Peru's unit of currency is the sol (100 centavos), the current rate of exchange being $0.25 United States currency.

Mining methods used are some form of shrinkage stoping. The veins in general are quite narrow, with stoping widths averaging 1 m. Where required, timbering is done with native wood. Imported pine is used for shafts, chutes, and in places where the irregular native timber cannot be utilized.

The Mining Districts—The Pataz belt is situated on the eastern side of the Andes. Mines in it are in the Department of Libertad, in the Province of Pataz. The trip thither is made from the port of Salaverry by road to Quirivilca-Huamachuco-Pataz. Another route to the southern section of the district is by train from the port of Chimbote to El Choro, and then by horse to Sihuas-Quiches. The distance from the coast over both routes is about 125 miles. From Lima the trip by plane requires only a few hours. The belt is about 100 miles long, and contains many historical mining centers such as Tingo, Pataz, Piaz, Soledad, Parcoy, Gigante, Letecia, Buldibuyo, Huayllillas, and Tayabamba. Elevations vary from 7,000 to 12,500 ft. The veins have a northwest-southeast strike, and dip northeast. They roughly parallel each other, and because of gravel beds and extensive vegetation it is difficult to trace them. Limestones, shales, and slates underlain with schists form the country rocks of sedimentary origin. Intrusive rocks are andesites-diorites, with the fissure type veins cutting across the sediments and igneous rocks. The vein filling is quartz, and the gold is found both free and combined with other minerals. The sulphides include pyrite, arsenopyrite, galena, and sphalerite. Most of the gold appears to be closely associated with the sulphides.

Extensive old workings are found throughout the district. The mines were worked for a considerable time before the Spanish Conquest, and large dumps were found by the more recent prospectors now active in the region. The oxidized outcrops carried high values in gold. Unquestionably, these surface openings yielded a large amount of gold. A descrip-

Table III—Principal Producers of Gold in Peru and Their Output

Company	Department	Year	Kg. Gold	Kg. Silver	Kg. Copper
Cia. Aur. Nazca	Ica	1937	676.133	102.481	538.00
Cia. Aur. Saramarca	Ica	1937	499.806	470.564	2,563.00
Syndicato Minero de Parcoy S. A.	La Libertad	1937	495.983	127.972	222.00
Northern Peru Mining and Smelting Company (Pataz precipitation)	La Libertad	1937	428.749	410.906	981.253
		1936	603.758	635.646	1,408.355
		1935	728.767	726.470	2,902.851
Northern Peru Mining and Smelting Company (Salpo concentrates)	La Libertad	1937	279.913	42,847.135	.....
		1936	286.085	41,342.107	.....
		1935	339.778	42,051.507	.....
Cia. Aur. Buldibuyo	La Libertad	1937	120.673	138.953	66.00
Cia. Cotabambas					
Auraria (footnote [1])	Apurimac	1937	559.383	1,874.990	375.00
(footnote [2])		1937	12.932	63.558	433.00
Cia. Minera Nacional (footnote [3])	Junin	1937	489.736	261.900	.....
Cia. Rizo-Patron (footnote [1])	Junin	1937	196.790	5,459.930	.....

[1] Mineral [2] Concentrates [3] Produced 9.28 tons copper and 97.91 tons lead.

tion of the mines now in operation may be of interest.

The Parcoy mine is operated by the Syndicate Minero de Parcoy, S.A. The ore extracted is given straight cyanide treatment in a 200-ton mill. Average tonnage handled at the mill since it was placed in operation is about 135. A considerable number of old workings were encountered along the outcrop of the main veins. These were worked by the Spaniards, and contained high values in gold. The main vein strikes N. 40 deg. W., and dips east 45 to 55 deg. Most of the values are found in the sulphides, though a small amount of free gold is present in the quartz gangue. The veins are found near the contact of the intrusive, locally called a diorite.

Veins in Eruptives Developed

A large part of the development work carried out so far has been in the veins found in the eruptive rocks. Veins in the sediments have not yet been explored, and little is known concerning their true value. Up to Dec. 31, 1937, the mill had operated 379 days. Material treated amounted to 48,500 tons (metric), with the average recovery and tailings being 14.35 grams and 1.84 grams per ton respectively. The mine is not yet completely developed, but underground work is being pushed and an increase in mill capacity is being planned. In 1937 some 2,800 m. of drifting, tunneling, and underground development were done. The tonnage of positive and possible ore is about 200,000 (metric), assaying 17 grams gold.

One of the oldest producers in the district is the Pataz mine, operated by the Northern Peru Mining & Smelting Company, which has been shipping precipitates to the smelter. Another old mine is being operated by the Cia. Aurifera Buldibuyo. The main vein, known as the Santa Teresa, dips about 40 deg. east, and is from 3 to 4 ft. wide in the upper levels. A fair tonnage of ore assaying about 20 grams per ton has been developed. The country rock is a light gray andesite. Vein filling is quartz, the gold being associated with pyrite.

The southern end of the western or coastal belt contains a number of interesting properties. They include the Saramarca, Nazca, San Luis, Calpa, Alpacay, and Andaray, apart from several prospects which warrant attention. Several 200-ton mills are in operation. Further inland and at a higher elevation there is the old Cotabambas mine, in the Department of Apurimac, which has been a steady producer for years. The properties to be described are more or less associated with the batholithic intrusion found along the coast.

The San Luis mine is approximately 75 miles from the port of Lomas on what is known as the lower plateau, which is about 5,000 ft. above the Yauca River near the town of Caja. Its main mineralization is a fissure type vein striking N. 60 to 70 deg. W., dipping 60 deg. N. The country rock is a series of granodiorite intrusions with a well-formed granular texture. A number of small veins are found at the northern section of the property. Although these veins are narrow, they have been worked extensively, and there are indications that current development will open up some high-grade oreshoots. The main vein has a well-defined hanging wall and footwall, with a persistent value along the footwall section. Mineralization may be traced 4,500 ft. on the surface. The veins were worked extensively by the Spaniards, who packed the rich ore down to the river valley, where ruins of the mills, partly destroyed by floods, are still to be seen. Most of the gold was obtained from the soft gouge walls, the hard quartz generally found in the center of the vein being left in place.

The Spaniards opened up the outcrop by a series of *media-barretas* (inclined shafts), with small stopes, wherever they found soft high-grade ore. The *media-barreta* is about 50 ft. long at an angle of 35 deg., which subsequently is driven in the opposite direction at the same angle and for the same distance, thus forming a zigzag pattern. From each turn there was started a sublevel, and where mineralization of value was encountered, stoping commenced. By this method the old miners at all times were able to carry out the broken ore in leather pouches. In places vertical depths of more than 200 ft. have been found. Other veins worthy of development are the San Gabriel and the Santa Rosa. Both have been worked extensively, but values so far have not been as high as in the San Luis.

The San Luis Geology

In the mine under discussion, the country rock is a granodiorite cut by a number of acid and basic dikes. A large, well-defined basalt dike may be seen on the eastern side of the main vein. This is pre-mineral, and there is one that fills in a small fault on the main vein. A fault cuts through the northern end of the main vein, striking northeast. Ore reserves minable or positive, amount to about 160,000 tons, averaging 17 grams gold. Milling ore varies in grade. It depends on the grade of ore mined and on the grade sent to the mill, along with the cut-off limit desired in the operation of the property. Operations of this type generally have a cut-off value of 6 grams per ton. The ore is not refractory, there being in the upper zone considerable oxidized limonite or hematite with the quartz gangue. The gold is fine and free, being associated with the oxidized particles in the vein. Free gold, somewhat coarser in size, is found in the quartz. Oxidized copper minerals have been found, but in the upper zone they are of minor importance and cause no trouble in the treatment of the ore. They turn into pyrite and chalcopyrite in the primary zone.

Tramway Serves Mill

The mine and 200-ton cyanide mill are connected by a bi-cable aerial tramway capable of handling 200 tons of material a day. It is 12,000 ft. long horizontally, and the difference in elevation is 4,700 ft. The cables used are $1\frac{1}{8}$ in., $\frac{7}{8}$ in., and $\frac{3}{4}$ in. in diameter respectively. Line speed is about 500 ft. per minute, and the 10-cu.ft. buckets weigh 1,600 lb. each when loaded. Ore received at the mill is first weighed before it is dumped into two 15x16-ft. circular steel bins. From these it is directed by a conveyor belt first to a jaw crusher and then to two 20x20-ft. circular fine-ore bins. A sampling plant containing two Vezin samplers, rolls, a jaw crusher, and auxiliaries is available. Fine grinding is done in a 8x6-ft. Marcy ball mill fed by Denver Equipment ore feeders, and operating in closed circuit with a Dorr classifier. A Denver jig between the two units removes any coarse gold present in the circuit. On the grinding floor there are two 20-ft. tanks, one for the mill solution and the other for pregnant solutions. The solution section contains a 40-ft. primary thickener, whence the pulp goes successively to six 15x45-ft. Pachuca tanks, and four 12x40-ft. Dorr thickeners used for washing. In addition, there is a 10x30-ft. Hardinge clarifier and a 10x20-ft. wooden tank, which serves as a sump. The gold solution is treated by straight zinc-dust precipitation. Water for milling is obtained from the Yauca River. Electric power is furnishel by three 360-hp. Fairbanks-Morse diesel engines direct-connected to 300-kva., 440-volt, a.c. generators. Power lines carry current to the pumping station on the Yauca River and to the mine surface plant.

The property of Cia. Aurifera Saramarca is on the boundary between the Departments of Ayacucho and Ica, near the town of Palpa. Three sections of veins are worked—namely, Saramarca, San Pedro, and Apacheta. A series of altered flows make up the country rock. The main mineralization strikes N. 10 deg. E., and dips to the west at a low angle of 35 to 45 deg. Most of the work is being done on the 734 level, which connects with the old workings above. The vein varies in width from a few inches to several feet, forming lenticular shoots. Chalcopyrite, pyrrho-

tite, galena, and sphalerite are the principal sulphides. Gold occurs both free and in a combined state, with quartz as the gangue. For the last eighteen months production has averaged 70 kg. gold per month. The cyanide mill has a capacity of 200 tons, and mill heads assay about 15 grams per ton.

Cia. Aurifera Nazca operates near Nazca, in the Department of Ica. The mine, known as Sol de Oro, has been operated by the Spaniards, who extracted a good tonnage of ore. The main mineralization strikes east-west, dipping north 45 deg. on the average. In some places it is flat. The shear zone is wide, and as a consequence it is possible to pick up an oreshoot at any place along the strike. As the walls do not hold up well, most of the stopes have to be filled immediately upon completion. In the upper section of the mine left by previous workers, widths up to 15 ft. carrying milling ore have been opened.

In some sections of the mine a large amount of copper is found, which affects milling operations adversely. The gold is associated with the iron mineralization, pyrite and pyrrhotite, and its oxidized products. Some gold is found with chalcopyrite, the chief copper mineral. The main gangue minerals are quartz and calcite. Favorable conditions exist for the leaching of ores in this shear zone, and the oxidized section of the vein contains high gold values and small amounts of silver. Daily production is about 200 tons, which is treated at a 200-ton cyanide plant. Mine and mill are connected by an aerial tramway, but upon completion of the new Inca tunnel ore will be trammed direct to the mill.

Ore is treated by straight cyanidation, and grinding is done by two ball bills, with a jig to remove coarse gold. The power house contains Sulzer diesel engines, the fuel oil being obtained at a reasonable cost from the fields in Northern Peru. Complete camps for the staff and workmen are available. The company is the first to declare regular dividends.

Andaray Gold Mines are operating the old Andaray property in the Churunga River valley, about 9 km. above the junction of the Ocona and Churunga rivers. The mines are in the Province of Condesuyos, Department of Arequipa. The main vein strikes east-west and dips vertically. It varies in width from a few inches to 6 ft. and can be traced for 6,000 ft. on the surface. Three well-defined shoots have been developed to date. The Mercedes vein is opened up by nine levels, with ore showing in most of the faces. Mineralization consists of free gold, with sulphides of marcasite, pyrrhotite, pyrite, and small amounts of chalcopyrite and galena. Nonmetallic gangue minerals are calcite with quartz. The country rock is a syenite granular in texture and related to the batholith. Tonnage developed to date is not available, but some oreshoots in the old tunnel average 18 to 22 grams per ton. The Chappara vein on top of the hill has been worked extensively. This section of the vein is wider and development is being pushed here. A 25- to 35-ton pilot mill is being installed, to be followed by a larger capacity one as soon as conditions warrant such a change.

The Cia. Aurifera Cotabambas is active in the Province of Cotabambas, Department of Apurimac. Of the two routes to the property, the most satisfactory is via Cuzco. The trail is difficult and the trip requires two days' hard riding. The country rock is sedimentary. It is made up of quartzites, shales, slates, and others, and intruded in these beds is a syenite porphyry, which forms the main igneous rock found on Cerro Cochasayhuas. The main vein strikes N. 5 to 15 deg. W. There are several cross veins which carry some values. The main fissures cut across the sediments and igneous rocks, and a number of basic dikes intersect the entire formation. The veins are a few inches to several feet wide, with the mineralization found close to the wall rocks. Values are in the sulphides, which are complex. Chalcopyrite, galena, tetrahedrite, sphalerite, pyrite, and free gold are found in the quartz-rhodonite gangue filling. The ore being refractory, difficulties have been encountered in its treatment. Amalgamation, cyanidation, and flotation have been used. Production is given in the tables.

On the eastern watershed there are extensive fields for both lode and placer developments. Here, transportation is a problem, but it is possible that the difficulty will be overcome. The old Santo Domingo mine has yielded much gold in the past, and is still producing. Prospecting is difficult. However, with roads and other means of travel being slowly improved, the region bids fair to become a steady producer in the next few years.

The history of the Poto deposits is interesting. The properties were operated before the Spanish Conquest. Total production appears to have been large. Ramondi states that the deposits were discovered by escaped Spanish prisoners, but others who are well acquainted with the history of Peru aver that they have been known and worked for many years. There are many washings in the Poto area, such as Cuyo-Cuyo, Aporoma, Suchis, San Juan del Oro, along with the rivers of Sandia, Inambari or Huari-Huari, Pachani, Pulpipuli, La Mina, and Machicami. All have produced considerable gold in the past.

These placer and lode mines are in the district of Poto, Province of Sandia, Department of Puno. The best route from the coast is via Mollendo, Arequipa, Juliaca, Tirapata, and Poto. The distance is 400 miles, and the elevation of the plateau containing the placers is about 4,700 m. Various estimates are available as to the size, depth, and value of the gravels. In Poto there are two layers, the upper bed up to 300 ft. in depth, with recoverable values from 17 to 50c. United States currency per yard, and the lower or blue bed near bedrock, which is said to carry higher values. The actual size of the deposit is not known, as it has never been completely surveyed, but many reports indicate an average length of 6,000 m. width 300 m., and a depth of 150 m. The deposit warrants further study, and systematic work should prove the extent of the old channels. The country rock consists mostly of shales, slates, and others, Silurian in age. Numerous small quartz veins and stringers have been found in the area, and several high-grade gold veins have been worked in the past.

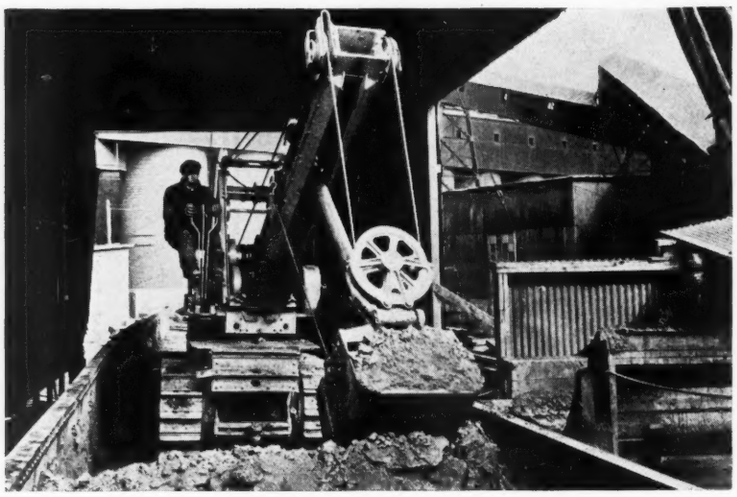
With such an ideal deposition of gold-bearing solutions in sediments, followed by extensive erosion, conditions are satisfactory for the formation of gravel beds along the rivers which have worked in the region during glaciation. High beds of old river channels also are found in the lower regions to the east, where swift rivers are cutting deep canyons. The gold is coarse but pure. Its fineness is 900 and up. Currently, this forms the bulk of the metal recovered. Use of newer and more efficient methods will result in the recovery of the fine gold now being lost. Production of gold from this Department in 1936 was reported as 478,394 kg., but additional gold has been sold to various metal buyers found in the country. The figure represents 10.09 per cent of the total gold produced in Peru.

Table IV—Exportation of Gold and Silver in 1937

Company	Kg. Gold	Kg. Silver
Nazca	676.133	102,481
Saramarca	499.806	470.564
Parcoy	495.983	127.972
Northern Peru Mining & Smelting Co. (Pataz Prec.)	428.749	410.906
Buldibuyo	120.673	138.953
Cotabambas	559.383	1,874.990
Inca Mining	104.664	4.329
	2,855.391	3,130.195
Blister Copper (Cerro de Pasco [1])	1.605.356	318.957.989
Salpo concentrates	279.913	42,847.135
Northern Peru Mining & Smelting Company		
Other concentrates	475.533	163,625.562
	5,246.143	528,560.881

[1] Cerro de Pasco buys concentrates from Cia. Minera Nacional and other small producers.

USEFUL OPERATING IDEAS



Unloading Concentrates With Tractor-Shovel

CONCENTRATES from several mines are shipped to the Noranda smelter, at Noranda, Que. They come in open-end flat cars and have to be unloaded onto a conveyor belt. They are heavy, and, with hand labor, this is inconvenient, unpopular, and expensive.

Taking space limitations into consideration, the Noranda company, in conjunction with Speeder Machinery Company, has developed a successful machine for unloading the concentrates. The Speeder company built a special shovel, mounted on a 56-in.-gage Caterpillar D6 tractor. Because the regular boom and dipper stick would prove awkward in the narrow quarters at the head of the conveyor belt and the standard bucket would be hard to handle, a 12-ft. boom, a 10-ft. dipper stick, and a ¼-cu. yd. bucket were provided.

A steel ramp, mounted on wheels with a level section long enough for the shovel to start working, is hooked onto a string of loaded cars. The tractor-shovel climbs the ramp, the car door is let down, and the shovel goes to work. Cables anchor the shovel to a certain spot near the belt and, as it eats its way up to the car, the tracks are engaged to move the cars under the tractor to the desired position. Thus the loader handles its own cars, increasing its production and leaving switch engines free to do other jobs.

Since the shovel has been in service, the smelter officials state that the work has been done at about one-third the cost of unloading by hand, this conservatively. The saving will amortize the first cost of the machine, after which the unit cost will naturally be lower.

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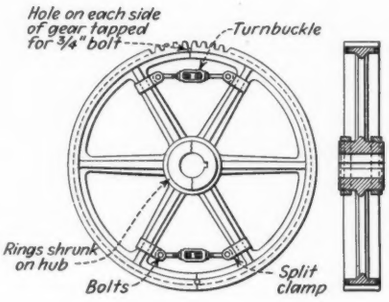


Repairing Large Spur Gear

AT A GOLD MINE in Mexico a long shutdown of underground development work was faced recently because of a broken 6-ft. spur gear on an electric hoist serving a 200-ft. winze. Unfortunately, no spare unit was avaliable, and the new gear ordered by telegram from the factory would not arrive in camp for at least three weeks. As so long a shutdown was not permissible, the broken gear was brought to the machine shop and repaired as shown in the accompanying sketch.

First, the gear was laid on the large planer table and leveled up so that the fractures would come well together. The blacksmith, in the meantime, prepared the split steel clamps and the turnbuckle arrangement attached to the arms of the gear as shown. A strong steel ring was then shrunk on each side of the hub, which in conjunction with the tightening of the turnbuckles, pulled the gear together until the cracks were hardly perceptible. Finally, some holes were drilled through the gear rim right in the cracks and tapped for ¾-in. bolts. The tightened bolts prevented any side movement of the broken halves.

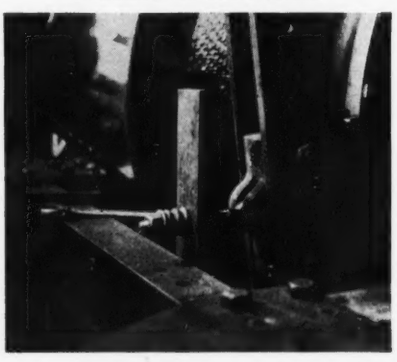
The repair was completed in less than eight hours, and the gear was still running without showing any signs of weakness four months after the arrival of the new unit. The main dimensions of the repaired gear are as follows: Diameter, 72 in.; width of face, 6½ in.; length of hub, 8½ in.; and bore, 6 in.

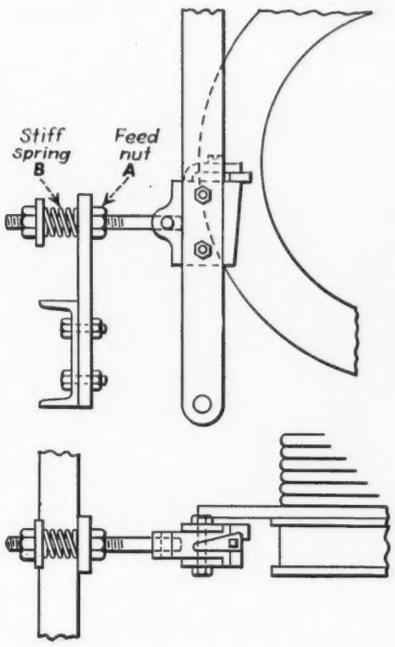
▼

Correcting Oval Brake Drums

RECENTLY a double-drum electric hoist delivered to Rosterman Gold Mines, Ltd., at Kakamega, in Kenya Colony, was found on erection to have oval brake drums, writes Harry Penfold, chief engineer and master mechanic for the company. The drums had been cast in half-sections and had presumably been badly set up for turning, as one was 1/16 in. out of round but fairly concentric, and the other was fairly round but about 3/32 in. eccentric. This eccentric motion of the one drum set up a movement of the brake lever, and alternately increased and decreased the pressure on the other drum every revolution, and made braking snatchy. Working with one unbalanced cage when it was unclutched

Machining the brake drums





The rig that was used in turning down the drums

was dangerous, so it became imperative to true up the brake drums. We had no lathe big enough for the job, and it was out of the question to rig up the slide rest from the lathe and turn them in position, as the overhang on the tool would have been too great. The rig shown in the photograph was therefore made and proved successful.

A cast-iron block was made to take the place of the brake shoe and was held with two bolts, and a step was machined on this parallel to the brake drum, so that a tool could be moved along parallel to the surface to be machined. A short piece of 4x1-in. iron bolted to the front member of the hoist took the pressure of the cut, and the tool was fed in by screwing down the nut *A* (see accompanying sketch). The spring *B* prevented the tool from jumping in after the high spot was passed. The cutting tool was a piece of drill steel faced with stellite. A cut about half an inch in width was taken, and the tool was fed in until the drum just cleaned up. There was naturally a slight amount of chatter, but a liberal supply of oil to the main bearings and insertion of a wedge under the hinge pin reduced this to a negligible amount.

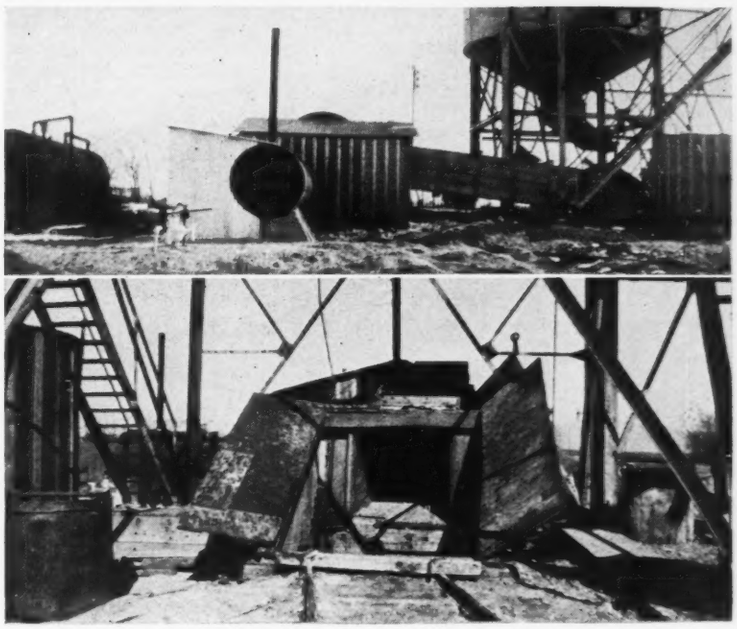
At first we attempted to drive the drum by running the motor very slowly, but the liquid controller heated up too soon, and so we finally turned by gravity, putting a truck full of waste in one cage and lowering down very slowly, checking with the other brake drum. The job took about ten hours to complete, which was quicker than disassembling and setting up in a lathe, and it was perfectly satisfactory in every way.

Keeping a Shaft Free from Ice

AN ARRANGEMENT for preheating air to prevent the formation of ice has been designed and installed in the Bailey field shaft of the St. Louis Smelting & Refining Company, southwest of Baxter Springs, Kan., under the supervision of H. H. Utley, district manager. The equipment includes an old boiler shell, 4 ft. in diameter by 15 ft. in length, with both ends removed; a natural-gas-fired heater; a 72-in. fan powered by a 20-hp. electric motor, and suitable housing for connecting the boiler shell with the collar of the shaft.

The heat and fumes from the gas heater pass into the flues at the intake end of the boiler shell and warm the outside air which passes around the outside of the flues. The fan, which is between the heating unit and the collar of the shaft, draws the air through the heating unit and then forces it to the shaft collar, where the natural downdraft carries it down the shaft at temperatures above the freezing point. During cold weather the unit is operated at night when no hoisting is done. Doors to the housing at the shaft collar are opened during the day to permit the hoisting of ore.

Top, the preheating equipment. Bottom, control doors at the shaft collar



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Measuring Leakage in Air Lines

A NUMBER of operators recently sought my advice on the subject of measuring leakage in compressed air lines, comments Walter S. Weeks, professor of mining, University of California, Berkeley, Calif. The best method[1] in my opinion is the following: Construct a low-pressure orifice meter and connect it with the receiver with a stop valve between the meter and receiver. Cut out the unloader on the compressor. Shut off air line from receiver and run all the air that the compressor handles through the meter. Close the valve to the meter until the usual mine pressure is held in the receiver and measure the air delivered by the compressor.

After this is done, close all valves in the pipe system except the one connecting line to receiver. This is left open. The air line and meter are now in parallel. Close valve to meter until usual mine pressure is held in receiver. Some of the air is going out through the leaks and some is passing through the meter. The sum of the two quantities is the volume delivered by the compressor determined by first test. Subtract meter air from compressor delivery and the difference is the amount that is leaking.

A description of the meter and a chart for rapidly computing the flow may be found in the accompanying reference.[2]

[1] See also: Weeks, W. S.: "A Method for Measuring Leakage in Compressed Air Lines," *E. & M. J.*, Jan. 7, 1922, p. 17.

[2] Weeks, W. S.: "Testing an Air Compressor," *M. & S. P.*, April 6, 1918, p. 479.

Summary of the

MARKETS

POLITICAL tension abroad increased during April and business suffered a mild setback, contrary to general expectations. The *E.&M.J.* index of nonferrous metal prices declined from 77.09 in March to 74.79 in April, reflecting lower domestic quotations for copper and lead. Zinc continued at the low level named soon after the tariff reduction was announced last November. Tin was fairly active and higher.

Failure of the London price to advance, plus continued pressure here in "outside" metal, finally resulted in a reduction in the producers' quotation for copper. The 11¼c. Valley price broke to 10¾c. on April 3 on offerings at the new level by the American Smelting & Refining Company. As no business of consequence developed at the reduced price, the same factor gradually lowered the quotation to 10c. The large mine operators followed the decline down to 10¼c. Inquiry picked up at the 10c. level, and, as the foreign and domestic limits came together, Phelps Dodge announced that it had raised its price one-quarter cent to 10¼c. This surprise move was followed by good business at 10¼c., but not until after those sellers who offered copper at 10c. raised their price one-quarter cent. Domestic sales for April, because of the activity that occurred late in the month, totaled 59,720 tons, against 28,618 tons in March. The March statistics failed to influence the market. A moderate gain in stocks was offset by the feeling that additional curtailment in production is in prospect.

Weakness in London forced producers to lower the price of lead 10 points to the basis of 4.75c., New York. Buying was in good volume at the decline. Zinc was quiet. With negotiations on to barter wheat and cotton for tin and rubber, consumers of tin became interested in the metal and bought a large tonnage at rising prices. Quicksilver advanced in sympathy with higher London prices.

UNITED STATES MARKET

1939	Electrolytic Copper		Straits Tin	Lead		Zinc
	Domestic	Export	New York	New York	St. Louis	St. Louis
April	(a) Refinery	(b) Refinery				
1	11.025	9.975	46.250	4.85	4.70	4.50
3	10.525@11.025	9.975	46.500	4.85	4.70	4.50
4	10.525	9.925	46.100	4.85	4.70	4.50
5	10.525	9.850	46.200	4.85	4.70	4.50
6	10.525	9.850	46.150	4.85	4.70	4.50
7	10.525	9.850	46.200	4.85	4.70	4.50
8	10.525	9.825	46.200	4.85	4.70	4.50
10	10.525	9.825	46.200	4.85	4.70	4.50
11	10.525	9.800	46.150	4.75	4.60	4.50
12	10.275	9.800	46.250	4.75	4.60	4.50
13	10.275	9.775	46.250	4.75	4.60	4.50
14	10.275	9.775	46.700	4.75	4.60	4.50
15	10.275	9.775	46.750	4.75	4.60	4.50
17	10.275	9.775	46.875	4.75	4.60	4.50
18	10.275	9.800	47.500	4.75	4.60	4.50
19	10.275	9.775	47.500	4.75	4.60	4.50
20	10.025	9.800	47.500	4.75	4.60	4.50
21	9.775	9.775	47.850	4.75	4.60	4.50
22	9.775	9.775	48.000	4.75	4.60	4.50
24	9.775	9.725	48.175	4.75	4.60	4.50
25	9.775	9.725	48.250	4.75	4.60	4.50
26	10.025	9.750	48.500	4.75	4.60	4.50
27	10.025	9.850	48.700	4.75	4.60	4.50
28	10.025	9.875	49.000	4.75	4.60	4.50
29	10.025	9.875	49.250	4.75	4.60	4.50
AVERAGES FOR MONTH						
	10.265	9.820	47.160	4.782	4.632	4.500
AVERAGES FOR WEEK						
5	10.817	9.946	46.342	4.850	4.700	4.500
12	10.483	9.825	46.192	4.817	4.667	4.500
19	10.275	9.779	46.929	4.750	4.600	4.500
26	9.858	9.758	48.046	4.750	4.600	4.500
CALENDAR WEEK AVERAGES						
1	11.025	9.971	46.508	4.850	4.700	4.500
8	10.567	9.879	46.225	4.850	4.700	4.500
15	10.358	9.792	46.383	4.767	4.617	4.500
22	10.067	9.783	47.538	4.750	4.600	4.500
29	9.942	9.800	48.646	4.750	4.600	4.500

SILVER, GOLD, AND STERLING EXCHANGE

NEW YORK AND LONDON

1939	Sterling Exchange		Silver		Gold	
		"90-day	(c)			(d) United
April	"Checks"	demand"	New York	London	London	States
1	4.677500	4.651250	(e)	20.0000	148s 6d	$35.00
3	4.680000	4.660000	42.750	19.9375	148s 5d	35.00
4	4.680625	4.656875	42.750	19.9375	148s 5½d	35.00
5	4.678750	4.655000	42.750	19.9375	148s 6d	35.00
6	4.678750	4.656250	42.750	20.0000	148s 6d	35.00
7	4.678750	4.656250	42.750	Holiday	Holiday	35.00
8	4.678750	4.655000	(e)	Holiday	Holiday	35.00
10	4.677500	4.653750	42.750	Holiday	Holiday	35.00
11	4.676250	4.646250	42.750	20.0000	148s 6d	35.00
12	4.676250	4.646250	42.750	20.0000	148s 6½d	35.00
13	4.676250	4.648750	42.750	20.0000	148s 6d	35.00
14	4.677500	4.647500	42.750	20.0000	148s 6d	35.00
15	4.676250	4.646250	(e)	20.0000	148s 6d	35.00
17	4.676250	4.648750	42.750	20.0000	148s 6½d	35.00
18	4.677500	4.651250	42.750	20.0625	148s 6d	35.00
19	4.676250	4.647500	42.750	20.0625	148s 6½d	35.00
20	4.676250	4.647500	42.750	20.0625	148s 6½d	35.00
21	4.676250	4.647500	42.750	20.0000	148s 6½d	35.00
22	4.677500	4.650000	(e)	20.0000	148s 6½d	35.00
24	4.676875	4.648750	42.750	20.0625	148s 6d	35.00
25	4.680000	4.653750	42.750	20.0625	148s 5½d	35.00
26	4.679375	4.653125	42.750	20.0625	148s 6d	35.00
27	4.678750	4.651250	42.750	20.1875	148s 6d	35.00
28	4.678750	4.651875	42.750	20.1875	148s 6d	35.00
29	4.677500	4.651250	(e)	20.1250	148s 6d	35.00
Average for Mo.	4.67778	.....	42.750	20.031	.....	35.00

AVERAGES FOR WEEK

April						
5	4.67906	. . ....	42.750	.....	.....	.....
12	4.67771	....	42.750	.....	.....	.....
19	4.67667	.....	42.750	.....	.....	.....
26	4.67771	.....	42.750	.....	.....	.....

Calendar week averages: New York Silver, 1st, 42.750; 8th, 42.750; 15th, 42.750; 22nd, 42.750; 29th, 42.750.

(e) Not quoted; Saturday.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Most sales in the foreign market are made on the basis of c.i.f. usual ports of destination—Hamburg, Havre, and Liverpool. The c.i.f. basis commands a premium of 0.325c. per pound above our refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly mined domestic. Under Executive order effective Jan. 1, 1939, the U. S. Government's price on newly mined domestic silver was continued at 64.64c. Handy & Harman's quotation for domestic silver, 999 fine, was 64⅛c. per ounce throughout April.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125 per ounce.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

1939	COPPER			TIN		LEAD				ZINC			
	Standard		Electro	Standard		Spot		3 months		Spot		3 months	
April	Spot	3 months	Bid	Spot	3 months	Buyers	Sellers	Buyers	Sellers	Buyers	Sellers	Buyers	Sellers
3	43.3125	43.5625	48.5000	216.2500	215.0000	14.3125	14.3750	14.5625	14.6250	13.3125	13.3750	13.5625	13.6250
4	42.8125	43.1250	48.2500	215.0000	213.7500	14.1875	14.2500	14.4375	14.5000	13.0625	13.1250	13.3750	13.4375
5	42.2500	42.5625	47.7500	214.7500	213.0000	13.9375	14.0000	14.2500	14.3125	13.0625	13.1250	13.3750	13.4375
6	42.6250	42.9375	48.0000	215.2500	213.5000	14.1250	14.1875	14.3750	14.4375	13.5000	13.5625	13.7500	13.8125
7						Holiday							
10						Holiday							
11	41.9375	42.2500	47.7500	214.0000	211.5000	14.0000	14.0625	14.2500	14.3125	13.2500	13.3750	13.5000	13.6250
12	42.1250	42.4375	48.0000	215.7500	213.2500	14.0625	14.1250	14.2500	14.3125	13.1875	13.2500	13.5000	13.5625
13	42.0625	42.4375	48.0000	215.2500	213.0000	14.0625	14.1250	14.3750	14.4375	13.3125	13.3750	13.5625	13.6250
14	41.8750	42.2500	47.5000	216.2500	214.0000	14.1250	14.1875	14.4375	14.5000	13.3750	13.5000	13.6250	13.6875
17	41.6875	42.0000	48.0000	216.7500	214.5000	14.3750	14.4375	14.6250	14.6875	13.3125	13.3750	13.5625	13.6250
18	41.6250	42.0000	47.5000	218.2500	215.7500	14.1250	14.1875	14.3750	14.5000	13.3125	13.3750	13.5000	13.6250
19	41.7500	42.0625	47.5000	218.5000	216.5000	14.3750	14.4375	14.5625	14.6250	13.3750	13.5000	13.5625	13.6875
20	41.8750	42.1875	48.0000	218.5000	216.0000	14.5000	14.5625	14.6250	14.6875	13.4375	13.5000	13.6250	13.6875
21	41.6875	42.0000	47.5000	220.0000	218.0000	14.5625	14.6250	14.6875	14.7500	13.5000	13.5625	13.6875	13.7500
24	41.0625	41.3750	47.0000	222.2500	219.7500	14.3750	14.5000	14.5000	14.5625	13.5000	13.6250	13.6875	13.7500
25	41.5000	41.8125	47.2500	222.7500	220.5000	14.3750	14.4375	14.5000	14.5625	13.5625	13.6250	13.6250	13.6875
26	41.7500	42.0625	48.0000	223.5000	221.0000	14.4375	14.5000	14.5625	14.6250	13.6875	13.8125	13.7500	13.8125
27	42.3125	42.6875	48.0000	224.2500	222.0000	14.6250	14.7500	14.7500	14.8125	13.7500	13.8125	13.8125	13.8750
28	42.3125	42.6875	48.5000	223.7500	223.7500	14.8750	14.9375	14.8750	14.9375	13.7500	13.8125	13.7500	13.8125
Average for month	42.031	.....	47.833	218.389	.....	14.337		14.533		13.443		13.637	

Prices for lead and zinc are the official prices for the first session of the London Metal Exchange; prices for copper and tin are the official closing buyers prices. All are in pounds sterling per long ton of 2,240 lb.

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(May 1, 1939)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	20c.
Antimony, domestic, spot, lb	11.500c.
Bismuth, ton lots, lb	$1.10
Cadmium, commercial sticks, lb	50c.
Calcium, lb., ton lots 97 @ 98 per cent	75c.
Chromium, 97 per cent grade, lb	85c.
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carolads, lb	28c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$35.00
Quicksilver, flask of 76 lb., 100 flasks or more	$92.00@$93.00
Radium, mg. radium content	$40.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$6.50
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 48 @ 50 per cent, c.i.f. Atl. ports, long ton	$19.50@$20.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.25
Mesabi bessemer	$5.10
Old Range non-bessemer	$5.10
Mesabi, non-bessemer	$4.95
Lead (Galena) 80 per cent, Joplin, Mo., ton	$52.94
Manganese Ore, c.i.f. Atlantic ports, long ton unit:	
52 @ 55 per cent	29c.
50 @ 52 per cent	28c.
44 @ 48 per cent	24c.
Molybdenum Ore, 90 per cent, per lb. of contained MoS_2	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	$19.50
Domestic, 65 per cent and upward	(a)$16.00@$18.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$30.00

(a) Prices at mines, small lots, usually several dollars less.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	3c
Cobalt Oxide, 70 @ 71 per cent, lb	$1.67@$1.77
Copper Sulphate, 100 lb	$4.25
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.42
Sodium Sulphate, bulk ton	$13.00@$15.00

ALLOYS

Berrylium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, lb	10½c.
Ferromanganese, 78 @ 82 per cent, gross ton	$80.00
Ferromolybdenum, 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 per cent, gross ton	$69.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.60

NON-METALLIC MINERALS

Asbestos, f.o.b. mines, ton:	
Canadian (Quebec)	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$45
Shorts	$12@$16.50
Vermont	
Shingle stock	$57
Paper stock	$40
Cement stock	$25
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 90 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$7.00
Bauxite, long ton:	
Domestic, chemical, 55 @ 58 per cent	$6.00@$7.00
Domestic, abrasive, 80 @ 84 per cent	$12.00@$14.00
Dalmatian, 50 @ 55 per cent	(a)$6.00@$7.00
French, 56 @ 59 per cent	(a)$7.00@$8.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$18.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in	15@35c.
2 x 2 in	30@50c.
3 x 3 in	75@$1.00
3 x 4 in	$1.00@$1.30
4 x 6 in	$2.00@$2.50
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	12c.
Silica, in bags, 325 mesh, ton	$18.00@$40.00
Sulphur, Texas mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$9.00@ $9.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$21.50
Basic	$20.50
No. 2 Foundry	$21.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.25

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1938	1939	1938	1939	1938	1939
January	44.750	42.750	19.895	20.305	499.895	466.775
February	44.750	42.750	20.159	20.370	501.722	468.472
March	44.446	42.750	20.088	20.280	498.394	468.370
April	42.750	42.750	18.880	20.031	498.046	467.778
May	42.750	.....	18.731	.....	496.673	.....
June	42.750	.....	18.945	.....	495.772	.....
July	42.750	.....	19.356	.....	492.855	.....
August	42.750	.....	19.389	.....	488.044	.....
September	42.750	.....	19.300	.....	480.240	.....
October	42.750	.....	19.613	.....	476.785	.....
November	42.750	.....	19.834	.....	470.587	.....
December	42.750	.....	20.083	.....	466.798	.....
Year	43.225	.....	19.523	.....	488.818	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine, London, pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents.

COPPER

	F.O.B. Refinery, Electrolytic				London Spot			
	Domestic		Export		Standard		(a) Electrolytic	
	1938	1939	1938	1939	1938	1939	1938	1939
January	10.198	11.025	9.908	9.912	41.387	43.125	45.387	48.440
February	9.775	11.025	9.525	9.735	39.597	42.188	43.563	47.375
March	9.775	11.025	9.496	9.888	39.772	42.938	43.582	48.120
April	9.775	10.265	9.443	9.820	39.306	42.031	43.408	47.833
May	9.375	.....	8.801	.....	36.668	.....	40.852	.....
June	8.775	.....	8.500	.....	35.235	.....	39.417	.....
July	9.585	.....	9.573	.....	39.744	.....	44.405	.....
August	9.900	.....	9.844	.....	40.591	.....	45.909	.....
September	10.028	.....	9.943	.....	41.864	.....	47.148	.....
October	10.760	.....	10.713	.....	45.646	.....	51.190	.....
November	11.025	.....	10.569	.....	45.244	.....	51.080	.....
December	11.025	.....	10.023	.....	43.428	.....	48.988	.....
Year	10.000	.....	9.695	.....	40.707	.....	45.411	.....

New York quotations, cents per pound. London, pounds sterling per long ton, (a) Bid quotation.

LEAD

	New York		St. Louis		London			
					Spot			
	1938	1939	1938	1939	1938	1938 3 mos.	1939 Spot	1939 3 mos.
January	4.870	4.826	4.720	4.676	16.135	16.253	14.534	14.744
February	4.632	4.805	4.482	4.655	15.402	15.525	14.283	14.417
March	4.500	4.824	4.350	4.674	15.992	16.075	14.660	14.860
April	4.500	4.782	4.350	4.632	15.579	15.623	14.337	14.533
May	4.400	.....	4.250	.....	14.210	14.376	.....	.....
June	4.148	.....	3.998	.....	13.969	14.012	.....	.....
July	4.882	.....	4.732	.....	14.921	15.034	.....	.....
August	4.900	.....	4.750	.....	14.371	14.480	.....	.....
September	4.998	.....	4.848	.....	15.249	15.401	.....	.....
October	5.100	.....	4.950	.....	16.173	16.313	.....	.....
November	5.091	.....	4.941	.....	16.088	16.223	.....	.....
December	4.842	.....	4.692	.....	15.106	15.275	.....	.....
Year	4.739	.....	4.589	.....	15.266	15.383	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton.

TIN

	Straits New York		Standard, Spot London	
	1938	1939	1938	1939
January	41.548	46.404	183.619	215.435
February	41.373	45.640	183.144	213.906
March	41.219	46.213	183.473	215.375
April	38.430	47.160	168.612	218.389
May	36.885	.....	162.693	.....
June	40.376	.....	177.429	.....
July	43.428	.....	192.542	.....
August	43.276	.....	192.966	.....
September	43.369	.....	193.733	.....
October	45.263	.....	206.911	.....
November	46.262	.....	213.909	.....
December	46.180	.....	214.450	.....
Year	42.301	.....	189.457	.....

New York quotations cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		London			
				Spot		
	1938	1939	1938	1938 3 mos.	1939 Spot	1939 3 mos.
January	5.000	4.500	14.994	15.173	13.682	13.887
February	4.813	4.500	14.408	14.589	13.522	13.780
March	4.417	4.500	14.364	14.477	13.728	13.961
April	4.141	4.500	13.729	13.919	13.443	13.637
May	4.042	.....	12.682	12.869	.....	.....
June	4.131	.....	12.890	13.104	.....	.....
July	4.745	.....	14.144	14.371	.....	.....
August	4.750	.....	13.467	13.675	.....	.....
September	4.846	.....	14.040	14.246	.....	.....
October	5.012	.....	15.083	15.232	.....	.....
November	4.924	.....	14.366	14.550	.....	.....
December	4.500	.....	13.709	13.861	.....	.....
Year	4.610	.....	13.990	14.172	.....	.....

St. Louis quotations, Prime Western, cents per pound. London, pounds sterling per long ton.

CADMIUM AND ALUMINUM

	Cadmium			Aluminum	
	1938 (a)	1939 (a)	1939 (b)	1938	1939
January	117.500	70.900	58.400	20.000	20.000
February	117.500	67.500	55.000	20.000	20.000
March	117.500	65.278	54.259	20.000	20.000
April	102.500	52.500	50.000	20.000	20.000
May	102.500	.....	.....	20.000	.....
June	102.500	.....	.....	20.000	.....
July	102.500	.....	.....	20.000	.....
August	99.722	.....	.....	20.000	.....
September	84.000	.....	.....	20.000	.....
October	80.000	.....	.....	20.000	.....
November	77.717	.....	.....	20.000	.....
December	72.500	.....	.....	20.000	.....
Year	98.037	.....	.....	20.000	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound; (a) average of producer's and plater's quotations; (b) producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1938	1939	1938	1939	1938	1939
January	13.750	11.670	79.240	77.440	36.000	34.440
February	13.750	11.250	76.455	85.227	36.000	35.000
March	13.750	11.269	72.444	87.278	36.000	35.000
April	13.654	11.500	71.019	90.800	36.000	35.000
May	12.460	.....	74.640	.....	33.400	.....
June	11.731	.....	80.731	.....	33.231	.....
July	11.030	.....	76.860	.....	36.000	.....
August	10.880	.....	75.500	.....	37.000	.....
September	11.310	.....	74.420	.....	39.000	.....
October	12.060	.....	73.480	.....	37.960	.....
November	12.250	.....	74.065	.....	36.217	.....
December	11.567	.....	76.769	.....	34.000	.....
Year	12.349	.....	75.469	.....	35.901	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk deduct .250c. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum is dollars per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1938	1939	1938	1939	1938	1939
January	24.50	21.50	23.50	20.50	24.00	21.00
February	24.50	21.50	23.50	20.50	24.00	21.00
March	24.50	21.50	23.50	20.50	24.00	21.00
April	24.50	21.50	23.50	20.50	24.00	21.00
May	24.50	.....	23.50	.....	24.00	.....
June	23.73	.....	22.73	.....	23.23	.....
July	20.50	.....	19.50	.....	20.00	.....
August	20.50	.....	19.50	.....	20.00	.....
September	20.50	.....	19.50	.....	20.00	.....
October	21.50	.....	20.50	.....	21.00	.....
November	21.50	.....	20.50	.....	21.00	.....
December	21.50	.....	20.50	.....	21.00	.....
Year	22.686	.....	21.686	.....	22.186	.....

Iron, dollars per long ton. F. o. b. Mahoning and Chenango Valley furnaces.

PERSONAL ITEMS

J. S. Coupal has been made the first director of the Arizona State Department of Mineral Resources.

S. Frank Hunt, discoverer of the Rio Tinto mine, in Nevada, has returned to Salt Lake City from a vacation trip to Hawaii.

Donald A. Callahan, mining man and attorney of Wallace, Idaho, has been appointed Idaho State Comptroller by Governor Bottolfsen.

W. B. Daly, manager of mines for the Anaconda Copper Mining Company, recently returned to Butte from a winter's sojourn in the South.

W. M. Webb has been made general superintendent of Michigan mines of Republic Steel Corporation, with headquarters in Bessemer, Mich.

R. M. Macaulay, general manager of Pamour Porcupine Mines, is making a visit to mining properties in the Johannesburg district of Africa.

Francis H. Brownell, chairman of the board of American Smelting & Refining Company, has been elected chairman, also, of General Cable Corporation.

J. A. Wilcox has been appointed mine superintendent of Shattuck Denn Mining Corporation, operating at Bisbee, Ariz. He was formerly engineer at the property.

S. M. Sneddon, who has been engaged in deep boring in New Zealand for several years, has joined the staff of New Occidental Gold Mines, N.L., Cobar, New South Wales.

Dean R. B. Ketchum, head of the School of Mines and Engineering of the University of Utah for the last seventeen years, has announced his retirement from the University faculty.

Luis Sigal, general manager of Sorr›mines Enterprises Corporation, of La Paz, Bolivia, recently arrived in New York to obtain machinery and equipment for the construction of a mill at his property.

E. H. Clifford, consulting engineer to British South Africa Company, has been appointed a director of Rhodesian Anglo American, Ltd., to fill the vacancy caused by the death of Sir Edmund Davis.

Frank O. Jasmer, an Arizonian who is a veteran mining man in Mexico, has assumed his duties as general manager of Cia. Minera The Golden Girl, S.A., Acaponeta, Nayarit.

Wade M. Dale, mining engineer and metallurgist, has joined the staff of the Sawtooth Supply Company, of Boise, Idaho. He will also conduct geophysical surveys for clients wishing geological determinations.

Harlowe Hardinge, for the last sixteen years vice-president and general manager of the Hardinge Company, Inc., of York, Pa., was on April 3 elected president of the company, succeeding **H. W. Hardinge,** who is now chairman of the board.

Charles E. Locke, long a member of the faculty of the department of mining engineering of the Massachusetts Institute of Technology, has been appointed acting head of his department. He succeeds **W. Spencer Hutchinson.** Professor Locke has been secretary of the Technology Association since 1930. As a mining engineer he is internationally known as an authority on the treatment of ores and has been in charge of this branch of mining education at the Institute for many years. He was graduated from the Institute in 1896. In 1901 he became a member of its teaching staff. Professor Locke is a member of the A.I.M.E. and other technical professional organizations. He is an honorary member of the Mining Institute of Japan.

CHARLES E. LOCKE

Charles T. Ferries, Frank J. Smith, Albert E. Petermann, and **Frank J. Kohlhaas** have been appointed to the board of control of Michigan College of Mining and Technology at Houghton.

Walter F. Galloway, recently with Sherritt Gordon mine, has left Manitoba for Arabia to become mill superintendent for Saudi Arabian Mining Syndicate at Jedda, Hejaz, Saudi Arabia.

William Garrison Hamilton, recently manager of Avon Gold Mines, Ltd., at Oldham, N. S., is now mining engineer and assayer with Gold Coast Main Reef, Prestea, Gold Coast Colony, West Africa.

H. E. Son, formerly sales manager for the Hegeler Zinc Company, has been elected as vice-president and general manager of the company with headquarters at Danville, Ill.

Stewart Campbell, former Idaho State Mine Inspector, and associates of Buffalo, N. Y., and Detroit, Mich., have taken over control of the Algoma Summit Gold Mines, Goudreau, Ont.

E. A. Slover will be superintendent of the new smelter at the Chino property of Nevada Consolidated at Hurley, N. M. He was recently assistant superintendent for the same company at McGill, Nev.

W. Craigie Hood, recently manager of Louvre Gold Mines, Senneterre, Que., is in British Guiana in charge of a placer operation on the Potaro gold field for Dwyer Elbow Kake Mining Syndicate.

A. F. McAskill, formerly of Mount Isa and later general manager of Mount Morgan, Ltd., is now general manager of the Commonwealth Portland Cement Company, Ltd., Portland, N.S.W.

F. H. Cash, of Hibbing, Minn., has been appointed general superintendent of Minnesota ore mines by the Republic Steel Corporation, with headquarters at Hibbing. The Corporation has discontinued its Duluth office, following the death of John E. Nelson.

Ernest W. Leighton retired from the London firm of Daniel C. Griffith & Company, assayers and metallurgists, on March 31. **Charles Fox,** who has been with the company for more than 30 years and for many years has been its general manager, has become a partner.

Dean R. B. Ketchum, head of the School of Mines and Engineering at the University of Utah, has resigned on account of poor health. Dean Ketchum plans to leave for an extended visit to Quincy, Ill., his former home. **A. LeRoy Taylor** was appointed to take the position of dean.

Dr. J. K. Gustafson, who for the past three years has been in charge of a detailed geological investigation of the Broken Hill ore deposit for North Broken Hill, Ltd., Broken Hill South, Ltd., and Zinc Corporation, Ltd., left Australia on April 10 for England, Europe, and the United States.

Merle H. Guise recently returned to his Seattle, Wash., headquarters after examining gold placers in Arizona and California. He expects to go to Idaho soon on examination work, after which he will go to Yukon Territory.

S. G. Blaylock, formerly vice-president and managing director of the Consolidated Mining & Smelting Company of Canada, was on April 28 elected president of the company, succeeding the late James J. Warren.

S. E. Stein, general manager, Southwestern Engineering Company of the Philippines, has returned to the United States because of ill health. He is succeeded by **E. R. Cullity,** formerly manager, mining department, Southwestern Engineering Company, Los Angeles.

Ralph Keeler, mining editor of the *Manila Daily Bulletin* and the Philippine correspondent of the *Engineering and Mining Journal,* has been appointed representative of the Chamber of Mines of the Philippines to the Golden Gate Exposition in San Francisco. He planned to leave Manila April 7 and to arrive in California by the end of the month. He will go across country to the New York World's Fair while in the States, stopping at Salt Lake City, Denver, and Washington en route. While

OBITUARY

Walter O. Borcherdt, assistant general manager of mines for the New Jersey Zinc Company, died at Mountain Lakes, N. J., on April 25, at the age of 56. Prior to coming to New York, Mr. Borcherdt was superintendent of the Bertha Mineral Company, at Austinville, Va., and while in that position originated and perfected a milling process for the ores of that property. In 1928 he conceived and designed the construction of the underground mill at Gilman, Colo. He was especially interested in flotation and contributed much to the advance of the art. He was a member of the Mining and Metallurgical Society of America and the American Institute of Mining and Metallurgical Engineers. He is survived by his widow, Mrs. Clara Borcherdt, and three children.

John E. Nelson of Duluth, Minn., manager of Northern Ore Mines of the Republic Steel Corporation, died recently at the age of 60. He was appointed manager of mines by Republic in 1933, coming from Negaunee, Mich.

Eugene P. McCrorken, mining engineer, who had long been chief of the mining subsection of the income tax unit of the United States Treasury Department, at Washington, D. C., died late last year at the age of 50. He was an alumnus of the Columbia School of Mines, and, following his graduation, worked in Colombia and Colorado. In 1919 and 1920, before entering the Federal service, Mr. McCrorken had been on the editorial staffs of *Engineering and Mining Journal* and *Compressed Air Magazine.*

Dr. Thomas S. Baker, president emeritus of Carnegie Institute of Technology, at Pittsburgh, Pa., and one of the most distinguished educators in the United States, died on April 7 in Pittsburgh four hours after suffering a paralytic stroke. Dr. Baker was president of Carnegie Tech for thirteen years, from 1923 to 1935, when he retired.

Frederick Bradshaw, mining engineer, died suddenly in San Francisco on March 10. Until about a year ago, Mr. Bradshaw was in charge of the Vallecito Western operations of Tonopah Belmont Development Company at Angels Camp, Calaveras County, Calif.

Charles Bernard Murray of Cleveland, Ohio, president of the firm of Crowell & Murray and especially well known in the Lake Superior Iron Country, was killed by an automobile on March 25 while crossing a street with Mrs. Murray, also fatally injured. He was 73.

E. R. Clark, Jr., 26, mining engineer on the staff of the Anaconda company, was fatally injured recently by a fall of ground in the Anselmo mine. Clark was a recent graduate of Massachusetts Institute of Technology.

George B. Dillingham, mining engineer of San Francisco and resident manager of the I.X.L. Mining Company, Balete, Masbate, P. I., died on March 14.

Christian Laurence Green, prominent in mining and civic circles in the Federated Malay States, died recently in Malaya, at the age of 45.

James Mitchell, a mining engineer long identified with the Rand, died on March 14 at the age of 79.

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in the States his mail address will be care of the American Express, San Francisco.

Edgar Hutton Dix, Jr., chief metallurgist of the Aluminium Company of America, will deliver the 1940 Institute of Metals lecture of the A.I.M.E. The address will be the eighteenth of a series of annual lectures and will be delivered at the regular meeting of the Institute next February.

A. R. Merz, general superintendent of both Roan Antelope and Mufulira smelters, has tendered his resignation, effective July 1, 1939. **A. B. MacLaren,** at present superintendent at Mufulira, has been appointed superintendent of Roan Antelope smelter and general superintendent of Roan Antelope and Mufulira smelters, also effective July 1.

T. Ekstam, chief engineer of the Luossavaara-Kiirunavaara Iron Mines open pit at Kiruna, and **D. H. Garde,** manager of the company's underground mine at Malmberget, are making a tour of the United States, investigating transportation and related technical matters at large iron-producing properties. Both Kiruna and Malmberget are in Lapland and north of the Arctic Circle. The mines are reputed to be among the largest iron producers in the world.

W. Spencer Hutchinson, head of the mining engineering department of the Massachusetts Institute of Technology and discoverer of a new vanadium mineral called melanovanadite, has retired from the faculty of M.I.T., according to a recent announcement by technology officials. Professor Hutchinson was widely known for his contributions to technical literature and prior to joining M.I.T. had had extensive mining experience in the Western States and South America. He was at one time a director of the A.I.M.E. His discovery of melanovanadite was made in Peru while he was practicing independently in that country between 1903 and 1923.

A LETTER

Smelting Concentrates In a Basic-Lined Converter

The Editor:

PUBLISHED STATEMENTS have been made from time to time, especially during the past ten years, to the effect that it should be possible to smelt sulphide ores, particularly concentrates, directly to copper in the converter furnace, using this furnace as the matte producer. This to be done in a modified type of converter. What this modified type should be is admittedly, at present, unknown. A satisfactory theory must be established as to smelting requirements prior to attempting to design this modified furnace.

A satisfactory theory as to ideal conditions is as follows: Simultaneous oxidation of iron sulphide and union of iron oxides produced with silica, at given points at which the sulphides, the air, the oxides, and the silica are in contact for sufficient time and at a necessary heat for chemical action to form a proper slag.

This appears simple enough and not particularly original, but it differs from theory which is generally expressed by two or more succeeding equations. One modern textbook states, in effect, that in converter practice the ferrous sulphide floats on the surface of the matte and is slagged by added silica. Some early experimenters advised the addition of silica flux to alternate blows and added that this flux slagged the oxidized (past tense) iron. It is true that the basic converter does not meet this theory as to an ideal condition, but the conditions in this furnace are close enough to be practical. Further improvement lies along the line of meeting the ideal conditions of the theory.

This simple theory explains why the silica-lined converter made a more siliceous slag, and why Knudsen was able to produce slags up to 45 per cent silica. This was due not alone to the long contact of the slag formers, but also to the fact that the silica was submerged in the matte due to its superincumbent weight. It also explains why the pyritic blast furnace made metallic iron sows when running fast under extreme oxidizing conditions; here the subsulphides ran quickly to the hearth largely out of contact with silica. This is not a matter of mere hair-splitting argument, but a possible guide for the development of improved apparatus which will hardly be brought about by study but rather stumbled onto in every-day work by someone who knows what is wanted and can recognize the idea presented as what is required. The apparatus will probably be so self-contained and simple that the casual observer will not consider it was in anywise novel.

F. E. WING

Tacoma, Wash.

EDITOR'S NOTE: Our correspondent has had more than twenty years' experience in copper converting at Tacoma, Wash., and in Peru. Although retired, he retains a lively interest in copper metallurgy and has proposed a method of smelting copper concentrates in a basic-lined converter (U.S. Patent 2, 105,574, Jan. 18, 1938). His proposed method is a combined pyritic smelting and bessemerizing process, carried out in a battery of two or more suitable basic-lined converters, each of which will be operating at different stages of the process at the same time. Details are given in the patent specifications.

What Metal Statistics Show

APPREHENSION experienced by metal producers during April resulting from uneasiness over political developments abroad, exerted a depressive influence on the domestic industry. Statistics of lead and zinc are reflecting a satisfactory balance between production and consumption and an improvement in this situation covering copper is expected before the middle of the year. In March, output of copper abroad was higher than anticipated, but action taken to reduce production has not yet appeared. April figures are expected to show a reduction. Statistics here show further reduction in output is necessary to be in closer balance with consumption. Sales of copper improved, however, in April, 59,720 tons being sold, against 28,618 tons in March. Consumption abroad is holding up well and the outlook is for firmer prices.

The March statistics of the Copper Institute showed that world stocks of refined copper increased 13,277 tons, out of which total the United States contributed 11,538 tons and foreign production 1,739 tons. Blister stocks decreased 7,407 tons; 4,817 tons here and 2,590 tons abroad. The net gain in stocks—refined and blister—was 5,870 tons. This net gain compares with 12,065 tons added to the total supply in February, 25,544 tons in January, and 41,286 tons in December.

The Copper Institute's figures for the first quarter of 1939, by months, with several corrections, in short tons, follow:

	(a) Jan.	(a) Feb.	March
Production, crude:			
U. S. mine	55,307	49,913	50,182
U. S. scrap, etc.	13,729	10,371	11,247
Foreign mine	92,240	87,811	90,148
Foreign scrap	14,857	13,568	12,359
Totals	176,133	161,663	163,936
Production, refined:			
U. S. duty-free	66,182	59,175	66,246
Foreign	107,298	103,478	105,097
Totals	173,480	162,653	171,343
Deliveries, refined:			
U. S. domestic	51,059	48,067	50,486
U. S. exports (b)	3,768	3,310	4,222
Foreign	95,762	98,221	103,358
Totals	150,589	149,598	158,066
Stock at end, refined:			
United States	301,110	308,908	320,446
Foreign	178,949	184,206	185,945
Totals	480,059	493,114	506,391

(a) Corrected. (b) Duty-free copper.

Exports of domestic copper have fallen sharply this year, averaging 3,767 tons monthly in the first quarter, against 11,622 tons monthly in the last quarter of 1938. Reduced exports have complicated the problem of the producers to balance output against shipments.

▶ ZINC—Statistics for April by the American Zinc Institute indicate a balanced position between production and consumption. Fairly large imports of foreign zinc continue to depress the domestic market, but this tonnage is not included in the domestic figures.

	Feb.	Mar.	Apr.
Stock at beginning	128,407	128,192	127,985
Production	39,613	45,084	43,036
Production daily rate	1,415	1,454	1,435
Shipments	39,828	45,291	40,641
Unfilled orders	29,987	38,447	29,314
Stock at end	128,192	127,985	130,380

Figures covering operations of the Prime Western division, for February, March and April, follow:

	Feb.	Mar.	Apr.
Stock at beginning	51,875	54,214	56,522
Production	18,266	20,813	20,152
Shipments	15,927	18,505	19,116
Stock at end	54,214	56,522	57,558

E & M J Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922-3-4)

1929	110.33	1934	69.59
1930	82.87	1935	74.66
1931	60.20	1936	73.45
1932	48.26	1937	90.86
1933	59.79	1938	73.67

	1937	1938	1939
January	87.03	75.56	77.12
February	91.68	73.43	76.89
March	103.78	72.41	77.09
April	98.62	71.19	74.79
May	93.25	69.15	....
June	93.21	67.55	....
July	93.82	72.95	....
August	95.28	73.94	....
September	94.33	74.70	....
October	85.26	77.61	....
November	78.91	78.36	....
December	75.18	77.13	....

▶ LEAD—Shipments of refined to consumers during March amounted to 40,871 tons, against 34,421 tons in February. Total production amounted to 40,799 tons, the daily rate being lower than in the preceding month. Stocks in the hands of producers were reduced 77 tons during March, making the total supply at the end of the month 122,035 tons. A year ago the stocks amounted to 143,511 tons.

The refined-lead statistics for February and March, in short tons, according to the American Bureau of Metal Statistics, follow:

	Feb.	March
Stock at beginning	117,214	122,112
Production:		
Domestic ore	36,391	37,790
Secondary and foreign	2,945	3,009
Totals	39,336	40,799
Domestic shipments	34,421	40,871
Stock at end	122,112	122,035

Zinc Production in the United States

The following final statistics of slab zinc production in the United States for the years 1936, 1937, and 1938, compiled by the American Zinc Institute, include the usual year-end adjustments and check with the annual figures of the United States Bureau of Mines, in short tons:

	1936	1937	1938
Primary zinc from domestic ore:			
By distillation	364,628	433,654	342,735
By electrolytic process	127,175	117,511	93,272
	491,803	551,165	436,007
Secondary zinc from ordinary type smelters	31,363	38,454	20,983
Totals (a)	523,166	589,619	456,990
Additional production (b):			
Secondary zinc from large graphite retorts	10,846	13,100	10,630
Totals, domestic	534,012	602,719	467,620
Primary zinc from foreign ore	329	5,739	10,334
Totals, all classes	534,341	608,458	477,954

(a) Totals correspond with American Zinc Institute's monthly statistics. (b) Not included in regular monthly statistics.

Consumption of Zinc in the United States

Estimated use of zinc in manufactures during the last five years, in short tons, according to the American Bureau of Metal Statistics:

	1934	1935	1936	1937	1938
Galvanizing	152,000	195,000	242,000	252,000	198,000
Brass making	98,000	124,000	165,000	169,000	102,000
Rolled zinc	40,900	56,500	55,000	58,000	46,000
Die-casting	32,000	55,500	72,000	88,000	48,000
Other purposes	37,000	42,000	48,000	39,000	27,000
Totals	359,900	473,000	582,000	606,000	421,000

The estimates for use probably fall a little short through failure to obtain a full accounting, the Bureau states. Under the classification "other purposes" are included slab zinc used for the manufacture of French oxide, zinc for wet batteries, slush castings, desilverization of lead, and sundries.

CALIFORNIA

Cyanide Plant to Be Built at Lava Cap Mine

Mill expected to be ready for operation around Oct. 1—Drift gravel mine near Auburn to be exploited—Yuba Associated Engineers, Ltd., considers use of gold dredges near Randsburg

▶ Otto E. Schiffner, vice-president and general manager, Lava Cap Gold Mining Corporation, Nevada City, has confirmed the report that his company has completed plans for the erection of a cyanide plant involving an expenditure of from $30,000 to $40,000. The new unit will handle all concentrates produced at the flotation mill which are now sent to the Selby smelter for reduction. Construction work is expected to be started within the next two months, following the completion of the test work now in progress, and it is planned to have the plant in operation on or before Oct. 1, when the contract with the smelter expires. Underground, Mr. Schiffner reports the establishment of the eleventh and twelfth levels at 2,100 and 2,300 ft. respectively, with crosscutting under way to contact the vein. The flotation mill at the Central shaft is treating 325 tons of ore a day, and 260 men are employed.

▶ Jose Oro Mining Corporation, controlled by San Jose interests, has acquired the Gaylord-Lavall drift gravel mine, about 2 miles southwest of Auburn, Placer County, and plans have been completed for the immediate installation of a treatment plant. The lease was obtained from a group of Auburn operators who worked the mine on a relatively small scale. A survey of the property was recently completed by the B. & H. Geophysical Survey Company of San Jose.

▶ Exploitation of gold-bearing placer ground by means of dredges a short distance from Randsburg, Kern County, is being considered by Yuba Associated Engineers, Ltd., Balfour Building, San Francisco. The tested ground is estimated to contain 5,000,000 yd. of commercial gravel, and current activities are centered in providing an adequate supply of water. Of the three wells to be drilled on the property, the first unit is expected to be completed within 60 days. Newton Cleaveland is president of the company.

▶ Hydraulic mining operations for testing available gravel at the Caledonia-McBride mine, in the La Porte district, Plumas County, will be started as soon as water is available from Canyon Creek. If the work proves successful it is planned to add several monitors to the present equipment for active operations. The property covers a part of the old Port Wine channel, and tailings can be stored behind Bullards Bar débris dam. The company also holds an option on the Turner holdings near Placerville, El Dorado County. L. F. Johnson is superintendent.

▶ Operations have been resumed at the Comet mine, near San Andreas, Calaveras County, leased recently by J. Lucientes, of Sonora, and J. L. Craig, of Stockton. Development includes a tunnel 400 ft. long with an 85-ft. winze. The 100-ton stamp mill at the property is being used for metallurgical test work. A 300-ton plant may be erected later if satisfactory results are obtained.

▶ Lode Development Company, operating the Rosencranz mine and mill, in Garden Valley, El Dodaro County, is sinking a two-compartment shaft on the Taylor property, acquired recently. A new headframe has been installed, and active development work continues at the Rosencranz mine, where the flotation plant is treating about 75 tons of ore daily. The company has also optioned the Clydesdale holdings adjoining the Taylor. About 40 men are employed in development work under the direction of Chas. H. Brown, superintendent.

▶ Acquisition of the Jumbo group of gold claims about 8 miles east of Independence, Inyo County, has been announced by Cuban-American Holdings, Ltd., headed by C. C. Coulter, of San Francisco. A 100-ton mill is to be erected at Kearsage station which will handle both custom and Jumbo ores.

▶ Cactus Mines Company, Roy S. Moore, manager, operating the Cactus Queen mine, on Middle Buttes, near Mojave, Kern County, is reported to have purchased the Gold Prince property from J. A. Otto and F. L. Wright, the owners. The mine comprises about 120 acres and lies north of the Cactus Queen holdings. A diamond-drill campaign, to be followed by extensive development work, is among the activities planned.

▶ Work is to be started soon on a new 150-ton flotation plant and assay office at the Standart mine, near Greenville, Plumas County, operated by the Indian Valley Mining Company. The new units are being built to replace those destroyed by fire a short time ago. Normally, about 32 men are employed at the property under the direction of G. L. Johnson, general manager. The company is headed by C. L. Hibbard, of Seattle, Wash.

▶ With dragline and gravel-washing equipment in place, the Dakins Company has started dredging operations on Deer Creek a few miles below Nevada City, Nevada County. The machinery was moved to the new dredge site after exhaustion of gold-bearing gravel at the Wolf Creek holdings of the company. R. D. MacAfee, Jr., superintendent.

▶ According to a report from Quincy, Plumas County, the old Cherokee property, near Greenville, idle since 1886, is being reopened by A. L. Merritt and associates, of New York and San Francisco. The Kettle shaft has been unwatered, and mining machinery is in course of installation as a preliminary to extensive development. Frank Humphrey is superintendent.

▶ Work is to be started soon on a new mill and additional surface plant buildings at the Believe It Or Not mine, near Susanville, Lassen County, operated by the Susanville Mining Company. John Holmes is president of the company, and R. L. Chester is manager.

MONTANA

Gilt Edge Mine Will Be Rehabilitated

Equipment being installed and development of gold property gets under way—Anaconda Copper Mining Company reports 1938 net income of $9,542,614, against $31,387,681 in 1937

▶ According to reports from Lewistown, crushing equipment has arrived for installation on the Gilt Edge mine. Recently, Lyman Brooks was appointed general manager of operations of the Gilt Edge Mining Company. Directors are Walter Lenz, C. S. Peables, and Le. E. Gray, of Wilmington, Del. It is reported that in addition to Billings and Sheridan, Wyo., interests, the Newmont Mining Company will be active in the development of the Gilt Edge property. The ores are mainly gold bearing and will probably require preliminary roasting prior to extraction by cyanidation.

▶ In the Judith Mountain area, work will be continued in the Gold Hill district near Maiden under the direction of James Braun. Gold properties about a mile west of the old Spotted Horse mine are being developed by Chicago interests.

▶ Anaconda Copper Mining Company's net income for 1938 was $9,542,614, against $31,387,861 in 1937. Total output of copper by the plants of Anaconda was 805,532,333 lb. The metallic copper production, after deducting 25,922 lb. contained in byproduct materials, was 805,506,411 lb. obtained from the following sources: 135,443,510 lb. was treated on toll for the account of others; 36,391,076 lb. was produced from purchased ores, concentrates, and secondary metals; leaving a net production from the mines of the company and its consolidated subsidiary mining companies through copper plant operations of 633,671,825 lb. (154,208,961 lb. domestic and 479,462,864 lb. foreign). This compares with a mine output of 843,622,162 lb. (277,850,047 lb. domestic and 565,772,115 lb. foreign) in 1937. Deliveries of copper from all sources, including purchased copper, for the year, in both the foreign and domestic markets, totaled 790,083,357 lb.

Zinc production amounted to 172,242,137 lb., which included 137,157,985 lb. obtained from purchased materials and 34,757,278 lb. on toll. Of total production of zinc, 11,681,268 lb. was contained in byproduct materials sold to other companies, 4,137,238 lb. was in dross, and 156,423,631 lb. was electrolytic metal. Deliveries of zinc amounted to 150,393,070 lb. Lead output totaled 64,163,568 lb., with deliveries amounting to 60,829,021 lb. Silver output for 1938 totaled 11,036,178 oz., of which 4,982,808 oz. was produced from the company's ores. Gold production amounted to 151,670 oz. Miscellaneous production included 4,850 tons of arsenic, 591,326 lb. of cadmium, 58,096 lb. of nickel sulphate, and 155,513 lb. of copper sulphate.

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A letter received from the Lava Cap Gold Mining Corporation, Nevada City, California, is typical of many received from operators all over the country. Under date of March 15, 1939, Mr. Otto E. Schiffner, Vice-President, wrote:

"We are very happy to submit the following comments on the use of your Exide-Ironclad Batteries.

"We have at this time fourteen Exide-Ironclad Batteries in use, batteries have been in use approximately four years, and we can state without qualification that they have exceeded our expectation in performance for dependability and freedom from trouble. The repairs necessary on these cells have been practically nil; due to which we have found a very large saving in handling ore underground with storage battery locomotives over hand-tramming, even where the number of cars moved is relatively small."

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Company and leasers' ores are treated in this 250-ton countercurrent cyanide mill of Producers Mines, Inc., at the Pilgrim property about 6 miles from Chloride, Ariz.

ARIZONA

Phelps Dodge Corporation To Build New Hospital

Structure will have a copper roof—Miami Copper Company reports recovery of molybdenum

▶H. M. Lavender, general manager of the Phelps Dodge Corporation at Douglas, announces plans for the construction of a new hospital at a cost of $150,000. The construction will be fireproof with copper roof. The present hospital building will be remodeled for a nurses' home.

▶Miami Copper Company, operating in Arizona, has constructed a small plant for the recovery of molybdenite from copper sulphide concentrate. According to the annual report of the company, this plant was put in operation in August 1938, and resulted in a small profit. In 1938, the company produced 54,910,255 lb. of copper, against 70,537,419 lb. in 1937. Gold and silver production was valued at $22,000 last year and molybdenum at $32,000.

▶Consolidated net income of the Phelps Dodge Corporation in 1938 was $8,656,823, before depletion, which compares with $12,740,772 in 1937, according to the annual report to stockholders. Total sales of copper in 1938 by the corporation, including sales by Phelps Dodge Refining Corporation (formerly Nichols Copper) for its own account, amounted to 358,576,899 lb. Production from the corporation's mines, together with metals produced from purchased ores treated at the Arizona smelters, for the years 1937 and 1938, follows:

	1937	1938
Copper, lb.	314,448,784	258,044,670
Silver, oz.	6,523,504	4,660,205
Gold, oz.	177,062	139,396
Lead, lb.	.....	7,116,326

The refineries at Laurel Hill, N. Y., and El Paso, Texas, were operated throughout the year and produced a total of 404,164,474 lb. of copper, 7,729,572 oz. of silver, and 193,659 oz. of gold. These totals, which include metals treated on toll and on a custom basis, compare with 497,171,000 lb. of copper, 8,343,279 oz. of silver, and 231,702 oz. of gold produced in 1937. The Morenci open-pit mine in Arizona, now being developed, will be ready for production in 1942, according to present plans.

▶Rehabilitation is under way at the Comstock-Dexter mines, near Hillside, preparatory to a resumption of operations. The property is equipped with a 100-ton flotation plant. T. F. M. FitzGerald, of Prescott, is president.

▶The Gold Standard Company is sampling and making a geophysical examination of the Thumb Butte property, which it optioned a few months ago. Richard de Smet is general manager of operations.

▶The Eagle group of claims, situated on the Cerbat Mountain, in the Stockton Hill country, was turned over to Murray F. Crossette on May 1 under lease and option. Dan Sheahan, of Las Vegas, Nev., will come to Kingman to take charge of the operations. Dan Hill and Joe Lee leased the property some months ago and developed excellent ore, making a number of shipments. They have turned their lease over to Mr. Crossette with the consent of the Clack interests, owners of the property.

▶Equipment is on the ground for the installation of a 50-ton flotation mill at the Oxbow mine, near Payson. The property is owned by Major John P. L. Walker, of Pawtucket, R. I. The property is under lease to Ernest Lill, of Magdelena, N. M., who has been operating a test plant on the property for some weeks.

▶The Equator mine, near Cottonwood, under lease to the Phelps Dodge Corporation, is shipping 300 tons of copper ore per month to the Clarkdale smelter. A. B. Peach, of Cottonwood, is manager.

▶The Harold Block lease, near Humboldt, has been taken over by the Bessie Mining & Milling Company. A 100-ton stamp mill is being installed and is expected to be operating early in May.

▶The Sheldon mine, in the Mayer district, is unwatering the shaft to the 500-ft. level and is now below the 300-ft. level. Three cars of ore per week are being shipped. At the same time the tailings dump is being worked by the Grand Canyon Mining & Milling Company, treating 250 tons daily. Recovery involves a new process of electrolytic amalgamation. M. E. Rogers, of Mayer, is general manager.

▶The Tom Reed Company, at Oatman, is considering installing a bowl classifier in its mill to treat 250 to 300 tons of tailings daily. About 250,000 to 300,000 tons of tailings are available for treatment.

▶The Vivian Mining Company, of Oatman, Arthur E. Dirrum, general manager, has taken over the Western mine, owned by the Consolidated Gold Mines Company.

▶A crew of 190 men is employed at the Gold Road mine of the United States Smelting & Mining Company at Gold Road. The cyanide plant is treating about 320 tons daily, of which about 40 tons are tailings. L. H. Duriez is manager.

IDAHO

Sunshine Mining Company Maintains Steady Output

Premier silver producer in the country increases ore reserves since first of year —Hecla Mining Company reports decline in ore production during 1938

▶In a report to stockholders of the Sunshine Mining Company at the annual meeting, Manager Ross D. Leisk stated that first quarter output of 1939 amounted to 2,232,018 oz. of silver, taken from 83,430 tons of mine ore. The ore yielded 27.7 oz. silver per ton. Manager Leisk said ore reserve had increased by 53,000 tons since Jan. 1, with the reserve now standing at 323,000 tons. The main Jewell shaft is now down 3,260 ft.

▶The A. L. Heine Mines Company, Wood River valley district near Bellevue, developing the Bellevue Gold group, plans to put the old time producer on a shipping basis soon. Dr. A. L. Heine, Boise, plans to begin immediate erection of a modern concentration and flotation plant with a daily capacity of 50 tons but with a crushing equipment for three times that amount, so that production can be increased later. About 50,000 tons of ore are reported blocked out. P. H. Miller is in charge of the crew of five men.

▶Orogrande Gold Corporation directors recently ordered a resumption of operations at its property near Elk City. Shipments will be made to the custom mill of the Clearwater Concentrating Company as soon as snow leaves the road.

▶Purchase of the Golden Anchor placer

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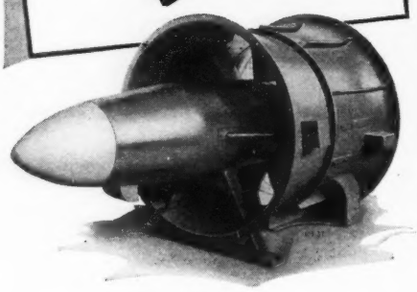

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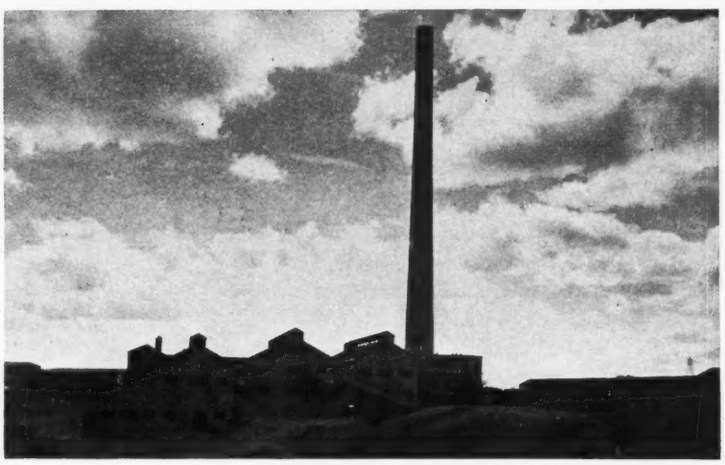
property, near Burgdorf, in Idaho County, by A. A. Hepburn, of Walla Walla, Wash., is reported.

▶ Sunshine Consolidated, adjoining the Sunshine mine, has extended its west drift a total of 2,250 ft., driven from the 1,700-ft. level of the Sunshine Jewell shaft. The drift will be continued to reach the Alhambra fault, according to President Frank Eichelberger, of Wallace.

▶ For the fiscal year ended Nov. 30, 1938, Polaris Mining Company mined and sold ore to the value of $973,986, according to report of President James F. McCarthy, of Wallace. Cost of production totaled $718,597.22, of which mining, milling, and operating expense amounted to $436,500.31. An average of 113 men were employed during the year, with their average annual earnings set at $2,090. Total taxes amounted to $706 per man employed and to 36.27 per cent of dividends paid.

▶ Hecla Mining Company mined 288,965 tons of lead-silver ore in 1937 and dropped to 273,311 in 1938, a decrease of 15,654 tons, President James McCarthy reports. Profits for the year were $718,715 after deducting all charges except taxes and depletion, compared with $1,700,054 for 1937. Unsold accumulated lead on hand on Dec. 31, 1938, amounted to 3,466 tons.

▶ American River Mining & Development Company, at Elk City, has resumed operations, according to Frank Cummings, superintendent, Elk City. The company moved its dredging equipment from Yuma, Ariz., to its American River location last fall, and worked most of the winter.



New smelter, reverberatory, and converter buildings and 501-ft. stack with Cottrell plant of the Nevada Consolidated Copper Corporation at Hurley, N. M. Operations are expected to commence early in May

UTAH

Utah Copper to Expand Transport Facilities

Sum of $1,000,000 involved in improvements—Work on Bureau of Mines Station started—Tintic Bullion finds high-grade gold ore on 1,300-ft. level

▶ A million dollars' worth of track work is to be carried on by the Utah Copper mine at Bingham for the expansion of trackage facilities. This was revealed when the company filed an application with the Utah Public Service Commission for permission to borrow $1,000,000 from the Kennecott Copper Corporation to finance the work.

▶ Mining men are gratified by the sudden shift in the fortunes of the proposed new mines experiment station building on the University of Utah campus. At a time when the outlook seemed hopeless, appropriation difficulties were ironed out. The contract has been signed by Ryberg Brothers, Salt Lake City contractors, and work has begun on the new building, which must be completed in seven months.

▶ Members of the Park City Local No. 99, International Union of Mine, Mill and Smelter Workers, and officials of the Silver King Coalition Parks Company have patched up their differences, relative to the posting of a work-resumption notice. The main cause of contention was adjusted when the company agreed not to require former employees to take physical examinations prior to expiration of the agreement on June 30, 1940. No date for resumption at the mine, which has been shut down since April 30, 1938, has been set, according to General Manager James Ivers.

▶ Development of high-grade ore in the Tintic Bullion property of the International Smelting & Refining Company by

the lessee, the North Lily Mining Company, has stimulated interest in the East Tintic district. Exploration work on the 1,300 level about 700 ft. from the North Lily shaft has yielded, it is said, two carloads of ore carrying exceptionally high values in gold. Samples are reported to range from 4 to 98 oz. gold to the ton. The vein lies in a brecciated quartzite, a formation which has been productive in only appreciable quantities in the East Tintic in the Eureka Standard mine.

▶ J. J. Beeson, Salt Lake geologist, has been engaged to direct operations at the Tintic Gold Mine, adjoining the Centennial Eureka at Eureka. Tintic Gold recently acquired a lease on 40 acres of the Empire Mines Company's ground. A number of shallow shafts are to be sunk on the Ruby claim, a crosscut driven on the 600 level to reach the Grand Central fissure, and further prospecting of the lead vein done on the 1,000-ft. level, said Mr. Beeson.

▶ William M. Knerr, for 22 years chairman of the Utah State Industrial Commission, was reelected chairman when the board reorganized for the biennial period beginning April 1. Frank A. Jugler, Ogden business man, who was appointed a member of the commission to succeed B. D. Nebeker, of Salt Lake City, was assigned to supervision of safety work.

▶ A number of Utah mining companies are reporting losses for 1938: Chief Consolidated Mining Company, a consolidated net loss of $78,380.35; ore sales totaled $196,625; operating and administration expense, $235,860. North Lily Mining Company, a net loss of $12,196; net proceeds from sale of ore produced during development, $18,433; royalties from leases, $10,136. Park Utah Consolidated Mines Company, net loss, $150,860 including $27,569 allowance for depreciation. Production was reduced to one shift on Jan. 8, 1938, and suspended on May 5.

▶ Net proceeds of Utah mines for the year 1938 totaled $12,316,271, compared with $37,196,527 for 1937, according to reports filed by metal-mining companies with the Utah State Tax Commission. Low metal prices and the shutdown of several of the State's largest producers—Park Utah Consolidated and Silver King Coalition Mines—were responsible for the drop. Only one mine, Park City Consolidated, with a net of $167,521, compared to $29,034, showed an increase. Utah Copper's net proceeds dropped from $30,626,225 to $10,495,303, Tintic Standard's from $969,818 to $397,500, and the United States Mining Company's properties at Bingham and Lark from $2,251,111 to $1,015,729. The net proceed figures mentioned above used for assessment purposes indicated that the total valuation of mines, based on the formula of two times the net proceeds for the year preceding, will be about $24,000,000 for 1939, or one-third of the valuation for 1938. This will reduce the total of Utah's assessed valuation of property about $50,000,000.

▶ The occupation tax paid on Utah mines—on 1 per cent of the gross proceeds—will decrease, it is estimated, from $542,000 for 1938 to $300,000 for 1939.

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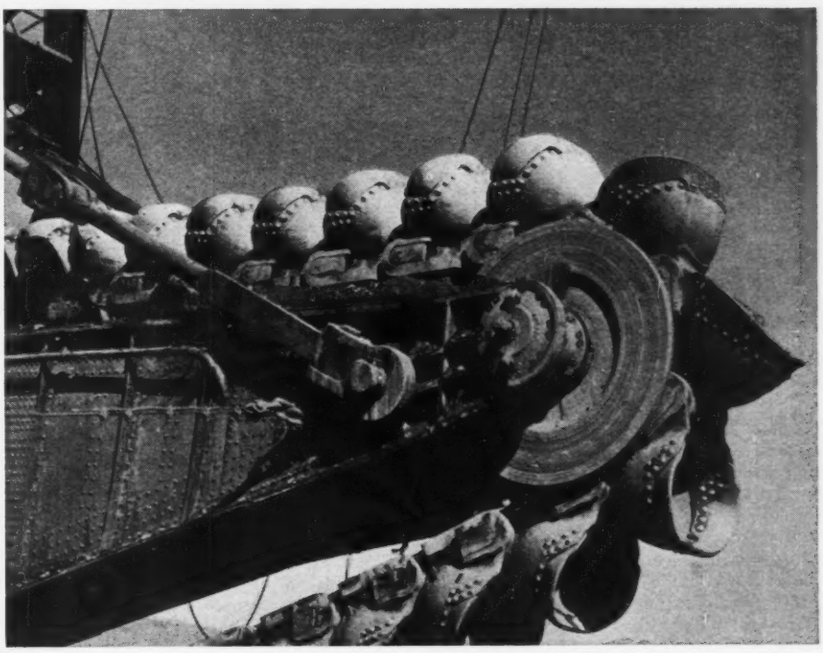

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NEWS FROM Washington

By Special Correspondent

WAR PLANS and politics vie for the spotlight in Washington. Some hotly partisan critics of the Administration are even charging that war crises are being used to hide domestic troubles for which they hold the Administration responsible. That, however, is not a general or popular view, because the vast majority of calmer and longer-visioned persons realize that partisan politics must stop at the seacoast under prevailing conditions.

Washington sincerely believes that the President's message asking for a ten-year military holiday may have given pause, at least briefly, to further aggression movements. Generally it is accepted that the best way to prevent war now is merely to seek postponement. As one realist remarked, "This is no time for pacifists to do any useful work."

Open and vigorous preparation for an aggressive defense of the Western Hemisphere is generally believed to be not only the determined policy of Mr. Roosevelt but also the most effective deterrent to complications for the United States. The guesses are now that the cash-and-carry Neutrality Act seems due for the scrap heap. Though Congress hesitates to grant the President too much opportunity for exercise of judgment in international matters, there probably is no alternative. Forecasters, therefore, generally expect a repeal of most, if not all, of the present neutrality law before Congress goes home.

Wage-Hour Problems

NEAR the end of April it appears that Congress will be asked to push through a limited revision of the wage-hour act. Mrs. Norton's original bill presented exactly what Administrator Andrews wanted. He is likely to get most of these items in a law this year. But legislation is to be restricted to those items, if it is at all possible. House action to that end can be controlled. What the Senate may do is another question.

Exemption from hour limitations of all employees paid $200 or more per month seems certain. It is more than likely that the Administrator will be given authority to make regulations having a valid status equivalent to law. Some change in the definition of those exemptions for agricultural industries operating within the "area of production" seems likely. A number of other helpful changes, simplifying and clarifying the effect of the law, will probably be added. There is no prospect that the wage-hour law will be extended to new types of employees. Andrews has plenty to do now. He is not asking for more trouble, at least not yet.

Spokesmen of the mining industry are working valiantly at the Capitol in their effort to get some maximum-hour exemptions which will permit easier scheduling of mining operations in isolated communities. They tell a persuasive story to those who sympathize with the practical mine-manager problem. But realistic forecasts indicate that not enough members of the House can be interested to put through such revisions in the face of clear opposition by Administration leaders. This opposition roots not so much in any unfriendliness to the mining industry. It represents far more a fear by Congressional and Executive folks that opening up the general provisions of the law in this fashion to *any* amendment is too dangerous, because then everybody will want his particular problem solved, too.

Strategic Surveys

THE bill providing for buying mineral stockpiles will also provide for extensive researches by the United States Geological Survey and United States Bureau of Mines. (See *E.&M.J.* January, 1939, p. 74.) There has been much speculation regarding just what commodities, what areas, and what procedure would be followed. This uncertainty is partly answered by the following statement and list which indicates tentative departmental decisions:

"Deposits that should be explored are chiefly those of the strategic metals antimony, chromium, manganese, mercury, nickel, tin, and tungsten. The principal localities in which deposits are known that particularly warrant investigation are listed in the accompanying tabulation. There are many other deposits that might be investigated later as the work advances.

Metal	Locality: State	Locality: County or Location
Antimony	Idaho	Valley
	California	Inyo
	Nevada	Lander, Pershing, Elko
Chromium	Wyoming	Converse
	Oregon	Grant and Josephine
	California	Siskiyou and Trinity
	Montana	Sweetwater
	Alaska	Kenai Peninsula
Manganese	Montana	Silver Bow and Granite (Butte and Philipsburg)
	South Dakota	Brule and Lyman
	Washington	Clallam
	Nevada	Lincoln and Clark
	New Mexico	Luna and Grant
Mercury	Nevada	Humboldt and Mineral
Nickel	Nevada	Clark
	Arizona	Mohave
	North Carolina	Jackson
	Oregon	Douglas
Tin	South Dakota	Lawrence
	Nevada	Lander
	California	Riverside
	New Mexico	Catron
	Alaska { Placer	Seward Peninsula
	Alaska { Lode	Seward Peninsula
Tungsten	Nevada	Pershing, Churchill, Lyon, Nye, and White Pine
	California	Inyo
	Utah	Tooele

Cotton-Tin Barter

SELDOM has there been so much publicity attached to confidential treaty negotiation as Washington notes in the plans for bartering American cotton and wheat for needed tin and rubber. Officials make no secret of the fact that Ambassador Kennedy at London had as one of his major assignments of April the formulation of a deal which would trade such goods with British and Dutch governments.

This deal, it is proposed, will take the form of a treaty which would require Senate ratification. It would provide that the United States will exchange surpluses of two of its agricultural commodities for the wanted tin and rubber. The deal would be made with the understanding that each country taking any of the goods would put them aside in a military reserve which would not be used except in the event of actual or immediately imminent hostilities, at least for a period of five years.

The State Department goes to great length to explain that these goods would not be forced into the world markets, that they would not in any way restrict the normal opportunity for commercial sales of like goods to or in the countries to which the cotton or wheat might go. The effort would be quite the contrary. It would tend to take out of the visible stocks of the world some of the goods which now hang heavily over the markets, at all times threatening to crush prices to even lower levels than those now current.

This movement for barter is quite independent and would not in any way interfere with the plans for purchase by the United States of necessary military reserve stocks of any minerals, including tin. Of course, it is to be expected that if Uncle Sam could pile up his wanted reserve of that metal by barter, he would not have to buy as much. This would merely divert the strategic materials purchasing fund to other commodities and thus eke out an inadequate sum.

What Is "Interstate"

THE area of interstate authority of Congress appears to be greatly extended by two recent Supreme Court rulings. In fact, so far as most of the mining business is concerned there appears to be left little, if any, "intrastate" activity. One case before the Court dealt with the authority of *NLRB* where it sought to regulate employment in a New Jersey manufacturing plant. That plant made goods and sold them *within New Jersey* to a firm that then took them to New York. The Court ruled that the Jersey processing was a part of interstate commerce, and that the employees of this processer were "subject to the National Labor Relations Act although not himself engaged in commerce."

The two dissenting Justices reasoned

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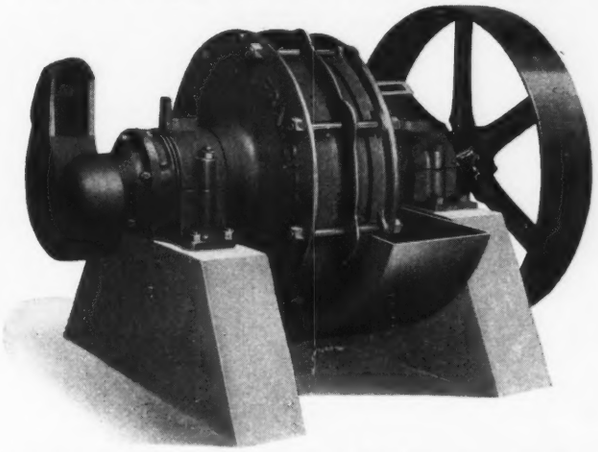

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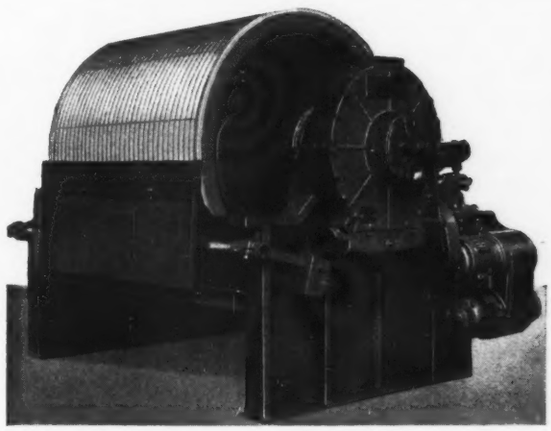

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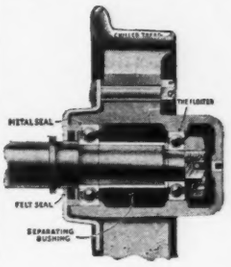

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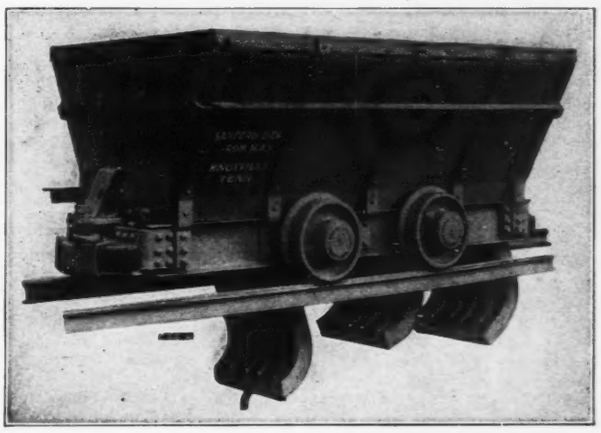

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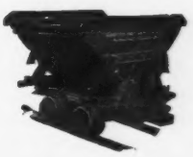

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from this majority opinion that logical construction of the Court ruling now puts Federal control over most, if not all, of the business activities of the nation. Although the majority does not accept that extension of its ruling, there appears to be little doubt that such extension will be practically in effect with respect to all mining enterprise which provides goods that go subsequently on an interstate journey.

In like manner, by a second decision of the same date, April 17, the Court gave added force to the Federal control of local business activity when it upheld Secretary Wallace in his regulation of the shipment of farm commodities grown in excess of state or individual allotments of *AAA*. If Congress is competent to prevent wheat or cotton from moving in interstate commerce beyond the quantities fixed by principles which Congress has set up, then there seems to be no doubt that other goods moving from the mining industry can be equally well regulated by Congress, if it chooses.

This would extend, according to Wage-Hour Division executives, to the control of hours and wages of workers who have produced the goods. In fact Administrator Andrews appears to feel now that the Supreme Court has so nearly directly approved affairs under the wage-hour law as to make doubtful the necessity for carrying any basic case to the highest court.

$100,000,000 to Spend

THE urgency of having reserves of strategic materials has so impressed Congress that enactment early in May is expected of the bill to provide $100,000,000 for purchase of such goods during the next four-year period. As then enacted the new legislation will differ somewhat from the original proposals drafted by the interdepartmental committee (frequently described in *E.&M.J.*) But essentially the plan is to have purchases made of goods to be put into stockpiles to be held as reserves until there is actual military emergency or such imminence of military activity as to justify the President in ordering these reserves used.

A board made up of Cabinet members will advise regarding the sort of goods to be purchased and how they may be procured. Suitable technical specifications are being drafted by Army and Navy authorities with the assistance of civilian advisers. There will be some advantage to American producers under the "buy American" law. But the military authorities are far more concerned over getting a usable quality and suitable quantity of these goods than they are in supporting any particular domestic enterprise, even when this has ardent Congressional backing.

The original plan related only to minerals. But the law as passed by both Houses is broader than this, including rubber, quinine, and any other goods that must come from abroad because domestic reserves or sources are inadequate. When such goods are perishable there may be use made of them for current needs of the Government or by sale, with replacement by fresh goods to maintain the reserve undiminished.

Congressional Plans

THE President would like to have Congress go home soon. Debate in either House or Senate resounds internationally much too loudly for comfort when the Executive has delicate negotiations on his hands. There is no expectation that additional reform legislation can be enacted this year. The President has everything to gain, nothing to lose, from early adjournment.

But there is little likelihood that he will be accommodated. Even the heat of a Washington summer is not enough to discourage members of Congress who want to make a record which they may parade next year before their constituents. The earliest believeable forecasts are therefore July. August is more favored by the old-time observers, who say "Something always happens to keep Congress in session longer than expected."

This expectation of an extended session gives the only real comfort to those who think that Congress ought to do something constructive for business by actual legislation. Certainly there is no chance for completion of extensive tax revision, for important modification of NLRB's authority, or for other appeasement measures before the dog days. And even the most enthusiastic business spokesmen do not seem to think that many business-boosting bills could be passed even if Congress stayed on into the fall. It is too easy to organize opposition to such measures—much easier than to form the necessary coalition *for* enactment.

News "Fines"

Wage-Hour or ICC — Transportation employees in privately owned motor carrier work for mining are either under the Wage-Hour limitations or they are under the ICC. Administrator Andrews takes the stand that these motor vehicle workers must meet wage-hour limitations unless, and until, the ICC exercises the authority which it presumably has to limit hours in the interest of safety. In any event these folks are under Federal jurisdiction.

Henderson to SEC—The New Deal aspect of Securities and Exchange Commission will be strengthened when Leon Henderson assumes membership in that body. Furthermore, this means increased emphasis on economics and somewhat less emphasis on the legal aspects of new mine security issues. It may also mean a serious weakening of TNEC's "monopoly inquiry."

Nitrate Prices—The Federal Trade Commission thinks that natural and synthetic nitrate prices are fixed in collusion by importers and domestic producers' selling agents. They intend to find out by the complaint procedure, which may lead later to a cease and desist order. This is one of the earliest recognitions by Federal Trade Commission that oftentimes intercommodity competition must be examined as well as competition between marketers of identical goods.

State Labor Laws—Washington reformers grieve that most of the state legislatures are adjourning without enactment of the state equivalent of NLRB. Critics of that body hope that Congressional delegates from these states will interpret this as meaning that the Wagner Act is not too popular back home, and needs revision this year.

Mining Assessments—There is enough political heat again this year, as usual, to cause proper blooming of the perennial legislation providing for suspension of annual requirements as to claim assessment work. The lack of conspicuous effort does not fool Washington observers, who confidently believe also that the President is not disposed again to veto such a measure with his popularity already uncertain in numerous prospector areas.

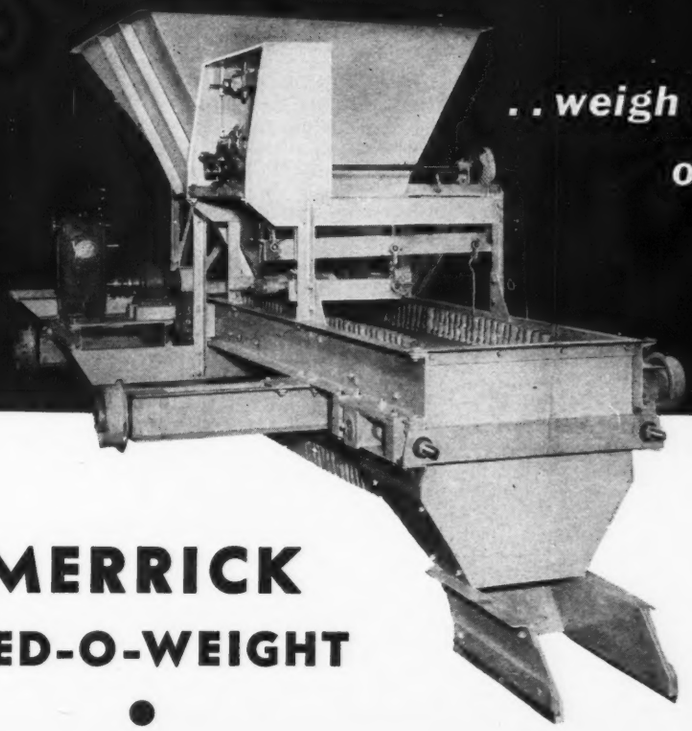
Minerals of Central Europe—There has been general recognition of the urgency of detailed knowledge regarding production and trade figures for the minerals of Germany, Austria, Poland, Hungary, Italy, and the late Czechoslovakia. The Bureau of Mines has done something about this, devoting its latest "Foreign Minerals Quarterly" exclusively to statistics on these subjects.

Interstate Barriers—Florida must not impose a tax equivalent to an import duty on cement made elsewhere. This, in effect, is the Supreme Court ruling which forbids continuance of the 15c. per hundredweight inspection levy made by Florida under the guise of protecting its citizens against inferior cement importation. Any division of the mining industry disturbed by such interstate tax barriers now has the Supreme Court word for it that such things must not be.

Identical Bids—Mere identity of bids constitutes evidence that "there is a combination to fix price." On this principle, automobile tire manufacturers are being hauled into court by the Department of Justice. Business observers in Washington hope that the court will decide in this case whether such presumption of guilt is adequate.

Government Reorganization — Regardless of the merit of departmental reorganization proposed by the President on April 25, there will persist the political charges that the main objective is to put more bureaus under administration leaders who will play ball according to New Deal rules. Little, if any, economy is expected. Even the critics hope, however, that there will be some simplification and rationalization of departmental relations.

Austria's Lead Production — Sharply expanded production of lead in what was formerly Austria is anticipated under the stimulus of Germany's "Four Year Plan," according to a report from Consul Sydney B. Redecker, Frankfort-on-Main, made public by the Department of Commerce. The leading factor in the Austrian lead industry is the Bleiberger Bergwerks Union, at Klagenfurst. In recent years the Union has operated only one mine at Bleiberg, which produced 10,800 tons of lead in 1937. Indications are that it is the intention to at least double Austrian lead output above levels prevailing before the Anschluss.



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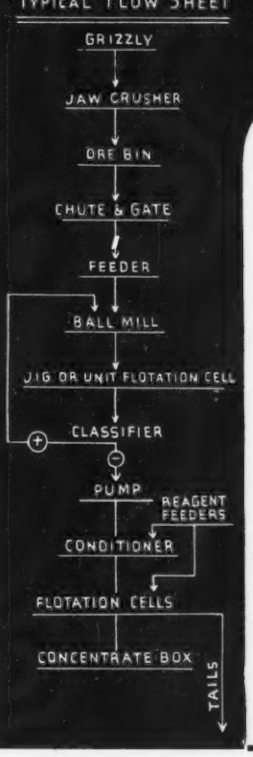

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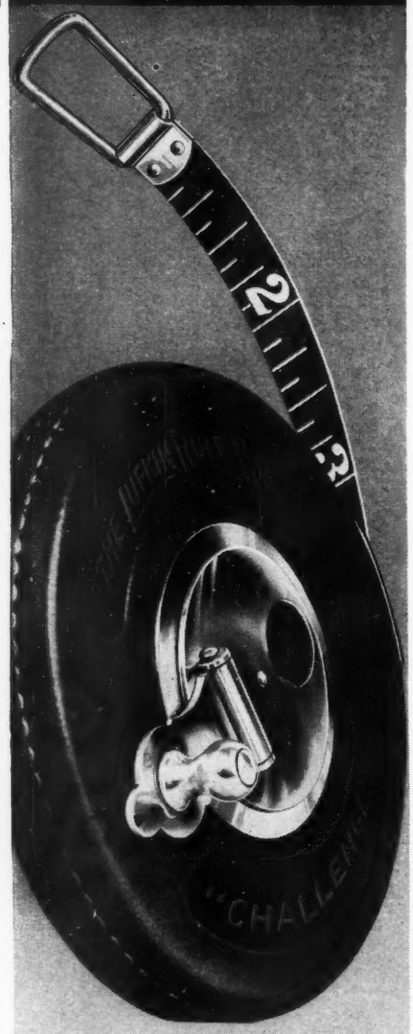

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COLORADO

New Drainage Tunnel In Cripple Creek

Known as Carleton Tunnel, it will be driven about 1,000 ft. below Roosevelt Tunnel and is expected to be 32,000 ft. long requiring four years for completion

▶ The new drainage tunnel, about 1,000 ft. below the present Roosevelt tunnel, is now virtually assured for the Cripple Creek district, as directors for the Carlton interests have voted unanimously for it. Engineering work will be completed in early May, so that work can be started soon after. A. H. Bebee, general manager for the Carlton Interests, has been working out the proposed portal and the course of the tunnel. The proposed tunnel will follow a line towards the Ajax shaft on Battle Mountain and its terminus will be at the No. 2 shaft of the Portland, which will be cut at the 31st level, 135 ft. below the bottom of the main shaft. Then a lateral will be driven directly under the Cresson. About four years are estimated required to drive the 32,000-ft. tunnel. To be called the Carlton tunnel, it will drain 30 square miles, or 20,000 acres of mining territory, to a depth of about 3,000 ft. The present Roosevelt tunnel cuts the Cresson mine at 1,900 feet; the new Carlton tunnel will cut it at 2,900 ft. And the properties at higher elevations, such as the Portland, the Ajax, the Vindicator, and the American Eagle, will all be cut at deeper depths. Work on the road to the tunnel site is now under way and the machinery and equipment will soon be installed for rapid work, as conditions in the Cripple Creek district are such as to permit year-around work. This tunnel will add many years to the life of the district and eliminate the tremendous cost of handling water at this time. The Ajax alone spent nearly $90,000 in 1938 for water and this in the same measure applies to the other mines that are working the lower levels.

▶ The Veta Mines Corporation, directed by Robert H. Sayre, of Denver, plans the erection of a crushing plant on the Pennsylvania mine this spring.

▶ Midnight Mining Company, at Aspen, is reported to have opened a body of rich silver ore.

▶ Following a brief shutdown to facilitate installing new machinery, the Mineral Farm Mines has resumed operations on the two-shift basis. A 300-ft. raise will be driven from the 3,500-ft. haulage tunnel, and is expected to intersect the ore developed in the upper workings.

▶ The Burleson Mines Company has acquired the Raymond group of claims on Gold Creek, Gunnison County, and started development work on the property. Sid Burleson is moving in men and machinery, and after cleaning out the old tunnel, which was driven some 2,890 ft., and retimbering it, will drive the tunnel an additional 1,500 to 2,000 ft. After completing the work on the road to the Raymond property, heavy machinery and other supplies will be brought to the mine.

▶ The Crusaders Gold Company, holders of the Sylvanite, Gold Bug, Repeal, Kankakee, Bonita, I. S. L., and King Pin claims, in the Animas district of San Juan County, are planning the erection of a 100-ton mill. George K. Townsend, superintendent, and Maude W. Russell, of Creede, Colo., general manager, state the principal values are in gold, with some silver.

▶ A joint royalty plan has been approved by the Carlton interests in the Cripple Creek district; also the Stratton interests, which are the two largest operators in this district. The rates, which became effective April 15, should add a lot to development work, as they will affect more than 5,000 acres of mining property and involve over 80 per cent of the leases on which royalties are paid. The new rates are graduated from 5 per cent on $5 ore to 25 per cent on ore valued at $50 or more, and will be settled on the mill assays. This new arrangement, however, does not affect those properties being worked on the split-check basis. Further, the Carlton and Stratton companies signed a joint agreement under which they agree to confine all boundaries of claims to the actual claims themselves, with no regard to ore vein apexes or extra lateral rights.

NEVADA

Copper Canyon Mining Company Plans Expansion

Mill to have greater capacity—High-grade ore found at Garfield mine—Giant Jumbo Mining Corporation plans development and shaft-sinking program

▶ The Copper Canyon Mining Company, at Copper Canyon and Copper Basin, southwest of Battle Mountain, in Lander County, is preparing for expansion in development and mill construction. Receipts for ore shipped to smelters in 1938 by the company and lessees, with miscellaneous revenue, were $80,372.51 and disbursements $61,594.62. A cash balance of $18,777 remained in bank at the close of the year. Herman Aaron, of New York, is president; Louis E. Whicher, of New York, treasurer; R. C. McCarthy manager and R. H. Raring resident engineer.

▶ A body of high-grade ore carrying silver, lead and gold has been opened in lease workings of the Garfield mine, situated about midway between Mina and Hawthorne, in Mineral County. The lessees report that recent work has developed ore of exceedingly high grade to the value of fully $100,000 in a short block above the 400-ft. level. J. H. Miller, of Hawthorne, is one of the principal owners of the Garfield mine.

▶ Desert Silver, Inc., reports 1938 production from its Nivloc silver mine and

200-ton cyanide mill near Silver Peak, Esmeralda County, of 769,922 oz. silver and 2,739 oz. gold from 69,678 tons of ore. Receipts, net of shipping and refining charges, were $572,065.13 and net income was $10,017.24. The company employs an average of 130 men. Ira B. Joralemon is president and Fred E. Gray is manager.

▶ Development work scheduled to start soon on property of the Giant Jumbo Mining Corporation in the Battle Mountain district, Lander County, will include sinking the main 850-ft. shaft below the 1,000-ft. point and driving a long crosscut on the 1,000-ft. level to ore zones opened on upper levels, preliminary to mill construction. Stanley F. O'Leary, president and manager, has been at Holyoke, Mass., and in New York. Tim Sullivan is mine superintendent.

▶ The remodeled 125-ton concentrating mill of the Gold, Silver & Tungsten Corporation in the Nightingale district, Pershing County, is now treating scheelite from a large deposit owned by the company and said to have an average content of 0.75 per cent WO_3. An option has been taken by the company on the Star scheelite property, five miles east of the Nightingale mine. J. G. Clark, of Boulder, Colo., is president and Alex Ranson is superintendent. The postoffice is Fernley, Nev.

▶ The report of the Consolidated Coppermines Corporation for 1938 shows production of 1,964,777 tons of ore from the Emma Nevada shaft and from leases, yielding 40,140,763 lb. copper, 22,494 oz. gold, 92,161 oz. silver, and 2,445 lb. of lead. The ore was treated in the McGill plant of the Nevada Consolidated Copper Corporation, a Kennecott subsidiary. Net receipts for the year were $983,847.64 and net income, before depletion, was $324,918.06. Current assets, including cash, receivables, inventoried and unsold copper, are listed at $2,854,736.12. It is estimated that over 5,000,000 tons of new ore were proved on 1938 by drilling. J. B. Haffner is general manager.

▶ Mountain City Copper Company, an Anaconda subsidiary operating in northern Elko County, made net profit in 1938 of only $73,948 after all charges but depletion, a net equal to 3¢. per share on 2,371,427 issued shares. This contrasts with a 1937 net of $1,059,299 or 45¢. per share on the same number of shares. The 1938 output was 13,065,832 lb. of copper and 1,754 oz. silver. At the close of the year Mountain City had copper on hand inventoried at $1,281,082. A substantial part of the inventory was pledged to secure notes payable, which total $450,000. In addition, the company owed its affiliate, International Smelting & Refining, $362,033 at the end of 1938, against $302,319 a year earlier. Current assets at close of 1938 were $1,522,865, including $18,983 cash, and current liabilities were $999,350. Production was suspended during several months of 1938. The mine and mill are now operating eleven days out of each fifteen, and because of bad roads, concentrate and high-grade ore are being stockpiled to await future shipment.

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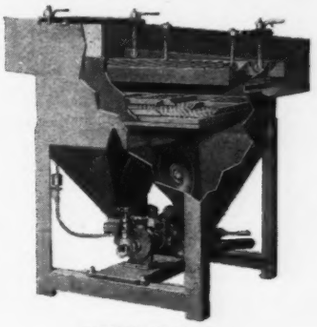

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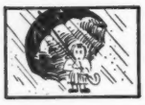

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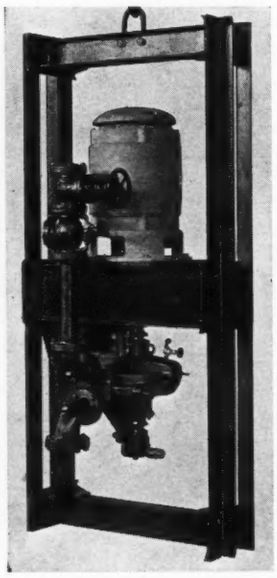

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American Zinc Institute Convenes At 21st Meeting in St. Louis

Members depressed over outlook for industry as recent lowering of tariff on ore and metal limits domestic operations

BURDENED with problems seeking to continue profitable operations in face of the present low tariff on imported zinc ore and metal, members of the American Zinc Institute met in St. Louis on April 17-18 to discuss the ill effects of this unexpected measure and to hear a well-rounded program that included papers on European zinc deposits, electrolytic zinc plants, the world zinc situation, and the influence of too much tin in galvanized sheets.

President Howard I. Young, presiding at Monday's first session, lauded the Institute and Tri-State Ore Producers Association for the splendid work and efforts employed in presenting the case of the zinc industry before the State Department in attempting to forestall any change in tariffs affecting zinc. Secretary E. V. Gent told members in his report that even though the tariff were lowered, the Institute would continue to present data to the Reciprocity Committee seeking to change this detrimental tariff measure. Julian D. Conover, secretary of the American Mining Congress, reviewed the legislative picture in Washington and confirmed the importance of the Institute's efforts in presenting facts in Washington showing how the tariff is opposing the general welfare of the domestic zinc industry.

The Monday afternoon session was presided over by Clarence Glass, of Anaconda Sales Company, who introduced George C. Heikes, chief mining engineer of the St. Louis Smelting & Refining Company. Mr. Heikes described the general geology of zinc deposits and approximate costs of production at zinc mines in Germany, Poland, and Italy. He estimated zinc ore reserves in Europe around 17,000,000 tons, against 12,000,000 tons in the United States. He said the low cost of labor in the foreign countries mentioned permits production of zinc and lead much below the cost of producing those metals in this country. In Italy, for instance, lead is a deficient metal and efforts are constantly being made to increase production, with a consequent greater output of zinc, which is left to be exported to obtain foreign exchange. George H. Cunningham, consulting engineer of New York, presented his paper entitled "Electrolytic Zinc Developments Abroad." He said many small plants have been erected in the last few years in countries seeking to becoming self-sufficient and to satisfy armament requirements. In most of these countries Mr. Cunningham believes operations are uneconomical.

A paper by O. W. Roskill, industrial consultant, London, England, was read by Evan Just, secretary of the Tri-State Ore Producers Association. Mr. Roskill's observations were that among zinc producers abroad it is becoming more and more recognized that zinc is a byproduct in lead mining because of technical improvements and economic influences. "Since the greater part of any decline in zinc prices abroad is passed back to the mine producers, the custom smelter stands to lose comparatively little by a fall in zinc prices and at the same time he is forced to maintain production in order to keep operating costs down to a reasonable level. For this reason, it has always been difficult to check the fall in zinc prices during periods when a relatively high mine production of lead has tended to give rise to an overproduction of zinc concentrate. The various factors outlined all tend in the long run to result in the lead-zinc mine producer receiving a relatively small revenue from the sale of his zinc concentrate, and have influenced mine producers in turning, with some justification, to the view that so far as they are concerned zinc in concentrate is a byproduct obtained in the course of producing lead and silver."

A joint session of the American Zinc Institute and the Galvanizers Committee was held on Tuesday. Charles A. Neal, of Miami, Okla., presided at the morning meeting. The subjects presented were: "Zinc in the Domestic Industry," by A. L. Murphy, of C. S. Trench & Company. Mr. Murphy held little hope of improvement in the domestic zinc industry so long as the tariff existed. Don Ross, of "Successful Farming," discussed the subject "The Farmer Roofs His Barn," and pointed out the growing demand for a good grade of galvanized sheet by the farmers of the country. Ray Crow, of the Tennessee Coal, Iron & Railroad Company, described the merits of "Sheet Steel in Low Cost Housing Construction." E. P. Finkbone, galvanizing consultant of the American Rolling Mill Company, presided at the afternon session and introduced Ernest Mantius, of the National Lead Company, who discussed the use of lead for acid-resistant equipment. G. C. Bartells, field engineer of the Institute, described the corrosion of some galvanized tanks found on farms in the Middle West, and W. M. Peirce, chief of research, New Jersey Zinc Company, described the analysis of the tank samples collected by Mr. Bartells. Mr. Peirce expressed the opinion, based on a number of tests that galvanized sheets having a high content of tin are likely to corrode more quickly than those containing a small amount of tin. Basing his opinion on the tests so far made, 0.3 per cent may be the limit of tin content in galvanized sheet for best service. Spangles on galvanized sheets are influenced by tin content.

Officers elected for this year were Howard I. Young, president; C. Merrill Chapin, Jr., John A. Robinson, and James O. Elton, vice-presidents Ernest V. Gent, secretary; John L. Good, treasurer, succeeds the late James Caselton.

TRI-STATE

More Ore Diverted To Central Mill

Changes being made by Eagle-Picher Mining & Smelting Company at some mines to facilitate ore transport to large plant—Evans-Wallower No. 7 mine placed in operation

▶ Production in the Tri-State area has been gradually increasing to an average of close to 7,500 tons of zinc concentrates per week by the latter part of April. This may seem strange, as most operations are probably uneconomic at present prices for concentrates, but can be explained by the fact that many operations have been idle most of 1938, and lease requirements are forcing operators to start up, regardless of economic conditions, or forfeit their leases. Demand has been good and smelters have been taking all available concentrates for the past several weeks. Stocks of concentrates in bins have been reduced to slightly more than one week's supply.

▶ The No. 7 mine and mill of the Evans-Wallower Zinc, Inc., north of Cardin, Okla., was placed in operation early in April. The mine had been idle for several years, and the mill, which had been converted into a tailings re-treatment plant, last operated early in 1938. Approximately 75 men are employed in the mine and mill, according to Floyd Gooch, manager for the company.

▶ The Scott mine and mill of the Century Zinc Company, three miles east of Picher, Okla., was placed in operation early in April, employing about 100 men, according to J. G. Trewartha, manager for the company. This mine had been idle since early in 1938 and extensive development work had been carried on in the interim.

▶ The Smith Milling Company, which was recently organized with S. A. Smith, of Joplin, as manager, has leased the tailings re-treatment mill and tailings pile on the Naylor land northwest of Treece, Okla., from the Baxter Chat Company. The mill, which had been completed late in 1937, but never operated, has a capacity of 60 tons per hour. It was placed in operation late in April, employing about twenty men.

▶ Eagle-Picher Mining & Smelting Company is actively engaged in changing equipment at several properties recently acquired from the Commerce Mining & Royalty Company, so as to divert the ore to its Central mill, according to G. C. Niday, manager of Tri-State operations of the company. New spur tracks to handle standard-gage cars were completed to the Hum-bah-wat-tah Nos. 1 and 2 shafts, and ore which formerly went to the Bird Dog mill will now be treated over the Central mill. Similar changes are being made at the See Sah and Blue Goose mines, and upon completion of the changes, the mills on these two properties will be closed. The Central mill, which had been working about four days per week, will increase its operating schedule.

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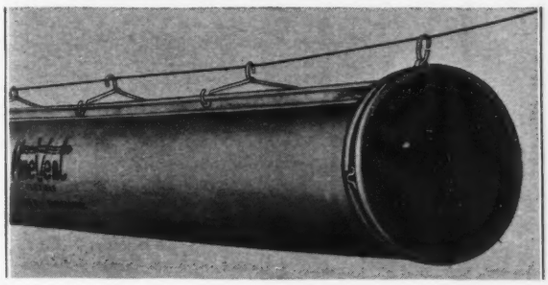

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IRON COUNTRY

Some Mines Scheduled For Higher Output

Preliminary estimates on iron-ore production for 1939 season indicate around 40,000,000 tons—Hill-Trumbull mine will operate this year

▶ Consumption of Lake Superior iron ores during March totaled 3,316,691 tons. Ore on hand at furnaces and Lake Erie docks as of April 1 totaled 25,872,124 tons. The balance on hand April 1st shows the iron ore industry to be in a very healthy condition, and the May 1 balance should run under 23,000,000, which is the lowest amount on hand for several years.

▶ The recent drop in ingot production has made the steel industry apprehensive and this is reflected in the iron-ore country. Various mine managers returning from the East are uncertain as to the future.

▶ Schedules have been made up by several of the companies and indicate a large increase over last season. The Arcturus mine of the Oliver Iron Mining Company, at Marble, Minn., will operate on a schedule of 300,000 tons this year and the Susquehanna mine of the Republic Steel Corporation will operate on a 500,000-ton program. Both of these mines were idle last season. The Great Northern Railroad Company handled about 6,000,000 tons last season and indications show that the company may handle 12,000,000 this season.

▶ The Hill-Trumbull mine of the Mesaba-Cliffs Mining Company will operate this year on a 800,000-ton schedule, and this mine was also idle last season. All of the active mines last year will be operating on increased schedules as compared with last season, and it is hoped that the total Lake Superior iron ore shipments will run between 35,000,000 and 40,000,000 tons.

▶ Butler Brothers have signed up with the C.I.O. on about the same conditions that were included in the contract which has been in force for some time. With the exception of the Wisconsin Steel Company and Butler Brothers, no other properties have been signed up by any labor organization. The same rate of wages is still in effect that was instituted during 1937, and it is expected that most of the employees will be working full time this season.

▶ The ice conditions have been very bad this year, and few boats reached the head of the Lakes before May 1. As there is no brisk demand for iron ore, this will not hinder the flow of this material to the furnaces.

▶ If the strike in the coal fields would last for some time, it may be likely that stocks of coal at the head of the Lakes will be shipped down the Lakes to supply the industrial plants in the radius of the Great Lakes, and coal men are mapping a program accordingly, to insure customers of some coal tonnage in case of necessity. Boats that were loaded with coal last winter and early spring have been unloaded at Lower Lake ports to save all tonnage possible in the event of continued tie-up.

▶ The Minnesota State Legislature has just passed a bill increasing the occupational and royalty taxes from 8 per cent to 9 per cent. However, legislation at this session was conservative, and a committee has been appointed to study the tax situation on the Iron Range. This may bring some benefits to this industry, which has been suffering heavy taxes for several years.

MICHIGAN

Copper Range Company Continues Shaft Sinking

A sub-shaft will facilitate exploitation of ground below 4,800-ft. level—Hoist being installed at No. 3 Ahmeek shaft to reach 55th level.

▶ Ore reserves in the Champion mine of the Copper Range Company are about the same as a year ago, although minable areas are becoming spotty and scattered, both of which make for more difficult mining. In No. 4 shaft, sinking will be resumed this year in the sub-shaft, through which all work below the 4,800-ft. level will be done. The sub-shaft was decided upon because the hoisting capacity in No. 4 has been reached. The hoist for the sub-shaft will be electrically operated. Although only 1,618,986 lb. of copper were produced from the Globe property of the Copper Range last year, out of a total of 18,010,937 lb., Globe eventually will become a large producer. This property, however, will produce only from the ninth and eighteenth level stopes until a sub-shaft connecting the two levels is completed, probably late this year. The sub-shaft was started at the ninth level to connect with the top of the shaft raise from the eighteenth level. Besides improving working conditions, the sub-shaft will facilitate the opening and mining of a substantial block of ground between the two levels.

▶ Copper Range will not resume operations at its tailings recovery plant at the Champion mill until the metal market improves. The plant is ready to resume on short notice.

▶ Only No. 12 shaft of the Conglomerate department of Calumet & Hecla Consolidated is in operation, and this branch will be worked out during the coming summer. Production thus will end from the famed Conglomerate lode, which has contributed the largest part of the approximately $186,000,000 paid by Calumet & Hecla in dividends. At No. 3 Ahmeek shaft a hoist from Tamarack No. 5 shaft is being installed, the present hoist having reached its capacity at the 45th level. No. 3 is being sunk below this point. The hoist being installed will have sufficient capacity to reach the 55th level on the incline, reaching the boundary of the Ahmeek property. New ground developed in No. 3 is fully equal in grade to that being stoped.

CANADA

Large Shaft to Develop Extensive Iron Deposit

Sinking will start soon and production is expected to begin next year—Some old mines in British Columbia are being rehabilitated

▶ Steep Rock Iron Mines, 135 miles west of Lake Superior, has proved a large body of high-grade hematite by means of 164 drill holes, of which 44 intersected the main iron body within a length of 4,000 ft. and to a minimum vertical depth of 1,400 ft. A mile south of the shaft on the main orebody three diamond drill-holes have indicated another iron deposit. The first shaft is designed for raising 2,000 tons a day. It is to be started this spring and will probably be five-compartment, situated on the mainland west of the main orebody. Waste rock will be used to build a railroad fill connecting a series of islands, on one of which a large production shaft will be sunk later. This development, leading to production sometime next year, is expected to have an important bearing on the industrial development of Central Canada. The property is controlled by Joseph Errington and associates. A geological survey of the area was made for the Ontario Department of Mines last summer by Dr. W. M. Bartley, who is of the opinion that iron ore at Steep Rock Lake was oxidized from a ferro-dolomite of igneous origin. Hematite is concentrated in faults and fractures in a breccia zone.

▶ The International Nickel Company of Canada increased inventories by more than four and a half millions to $32,141,057 in 1938, shareholders were told at the annual meeting last month in Toronto. The president, Robert C. Stanley, described inventories as consisting of fuels, fluxes, supplies of metals in process, and warehouse stocks of finished products. Being the principal source of the world's nickel supply, International must always have adequate stocks available for prompt deliveries in periods of industrial activity. At the close of the year, the company had 17,282 employees and a property investment of $158,350,836. Capital expenditures of $10,600,000 are planned for this year to keep down operating costs, including plant construction in Finland and mine development. At the company's mines and smelters an average of 50,000 tons of ore is being moved every day.

▶ The eleventh and twelfth levels at Little Long Lac Gold Mines have added almost 1,000 ft. of ore length. On the bottom 1,600-ft. level the new ore has been drifted on for 620 ft., grading 0.75 oz. across 4 ft. It is planned to explore deeper with diamond drills to determine whether the north dip of the main vein will carry it entirely within the arkose.

▶ Leitch Gold Mines, after two full years of production, is planning mill expansion to at least 115 tons daily by

WHAT ? ABOUT
AUTOMATIC COUPLING?

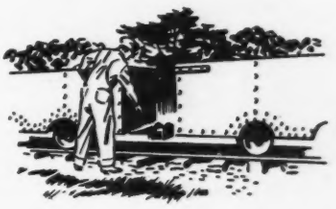
The interest displayed in automatic mine car coupling by operators, the country over, is evidenced by the multitude of questions we received following the introduction of the O-B coupler. In the following brief discussion we have attempted to answer some of the more important queries.

QUESTION: Is automatic coupling a current "specialty" or is it a significant trend?

ANSWER: The railroads of America, years ago, used link and pin coupling. The adoption of larger, heavier cars, faster haulage speeds, and the increasing emphasis on safety made automatic coupling a "must" in this industry. We believe the mining field is undergoing those same changes.

QUESTION: Am I limited to car dumping methods with this type of coupler?

ANSWER: Cars can be bottom, end and rotary dumped with O-B Automatic Couplers installed. The rotary dumping operation can be accomplished with cars coupled.



QUESTION: Is your coupler fully automatic?

ANSWER: The O-B Coupler engages automatically upon impact on any normal curve or straight track without prior alignment or adjustment, or manual assistance of any description.

QUESTION: How can I best apply automatic couplers to my particular operation?

ANSWER: Our engineers will gladly furnish a diagnosis of this application. Please send us the following information: 1. Method of dumping. 2. Center radius of shortest coupling curve. 3. Maximum vertical break in grade. 4. Blueprint showing car construction. 5. Other conditions peculiar to your operation.

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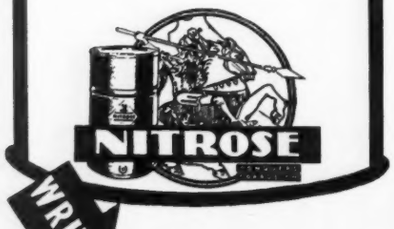

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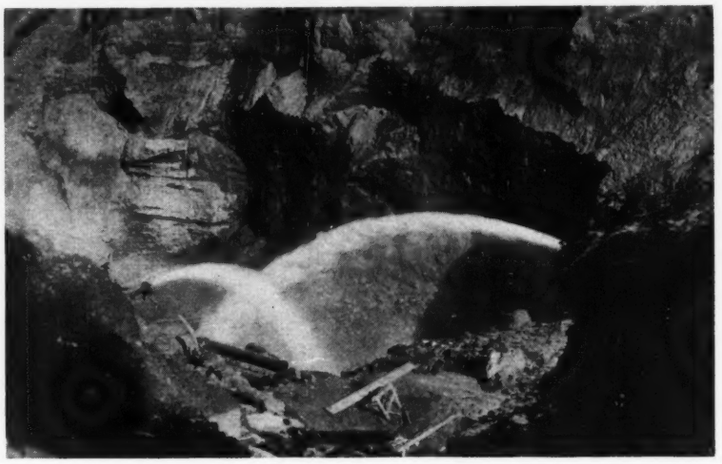

Monitors are again operating on the property of Lawhee Mining Company, Ltd., near the historic town of Barkerville in the Cariboo district of British Columbia

▶CANADA

adding secondary crushing. Ore reserves have been built up to approximately 75,000 tons, a three-year supply for the present mill, averaging $28 a ton.

▶Diamond drilling on the nineteenth and bottom level of Siscoe Gold Mines has shown ore conditions that are believed to be significant. Ore has been intersected in two holes and a third hole is being put down as a check. High values have been cut in recent exploratory drilling on the fourteenth level, but the picture is not yet defined. Production for the first quarter from the 625-ton mill shows average recoveries of $9.37 per ton, compared with $10.79 for all of 1938.

▶Sigma Mines in Quebec, a subsidiary of Dome, has been gaining outstanding results from development work in recent weeks. Three years' reserves for the present 700-ton mill have been established, and on all eight levels fast progress is being made in building up the ore picture. On six levels more than 500 ft. of new ore length was established by drifting in March. Average value of ore in sight is $7.64 a ton. Shaft sinking is proceeding to 2,000 ft. for opening eight new levels. Gold recovery is 97 per cent. In March the mill maintained an average daily run of 681 tons, the highest recorded since operations were started two years ago.

British Columbia

▶The 33d annual report of the Consolidated Mining & Smelting Company of Canada, Ltd., shows that profits in 1938 were adversely affected by low prices of the company's products. Revenue for the year was $28,087,996, and the net profit was $6,213,725. Dividends amounting to $8,164,587 were paid, leaving a balance in the surplus account of $3,573,937 at the end of the year. In presenting the reports the vice-president, E. W. Beatty, states that operations were conducted at capacity throughout the year with the object of keeping the normal force fully employed, and as a result large stocks of finished products have been accumulated. S. G. Blaylock, president and managing director, gives the accompanying summary of production in his report:

Product	1938	1937
Ore milled, tons	2,277,915	2,218,364
Lead, tons	201,574	206,579
Zinc, tons	149,071	142,650
Copper, tons	850	2,292
Gold, oz.	56,951	52,435
Silver, oz.	9,815,434	9,846,545
Cadmium, tons	255	218
Sulphuric acid, tons	134,469	132,194
Sulphur and fertilizer, tons	170,108	115,586

Operations at the Sullivan mine and Trail reduction plants were conducted without important change. Ore milled was of slightly lower grade, averaging in 1938 15.83 per cent of combined lead and zinc and 4.02 oz. silver, compared with 16.46 per cent of lead and zinc and 4.2 oz. silver in 1937. Last year three of the gold prospects that have been under development for some time were brought into production—the Con, in the Yellowknife district of the Northwest Territories, with a 100-ton mill; the Big Missouri, in the Portland Canal district of British Columbia, with a 500-ton mill which is being enlarged to treat 750 tons a day; and the Caribou, in Nova Scotia. A 1,000-ton plant is under construction at the Box property, in the Goldfields area of northwestern Saskatchewan.

▶A most promising outlook for Bralorne Mines, Ltd., is presented in the eighth annual report, covering the year 1938. Revenue amounted to $3,578,145, net profit was $1,754,492, and dividends aggregated $1,309,350, averaging $1.05 per share. Development work from the eleventh to the fourteenth levels will add considerably to the present reserves and exploration to a greater depth of 600 ft. will probably be started this year. Austin C. Taylor, president, states that a subsidiary company may be

formed to operate a property in central Nevada that appears likely to develop into at least a small mine.

▶ A gratifying performance was achieved by the Grandby Consolidated Company in 1938, despite the low price of copper. The annual report submitted by the general manager, A. S. Baillie, shows that the value of output was $2,762,155 and net profit was $227,043. From 1,223,492 tons of ore milled, there were produced 28,566,807 lb. of copper, 206,246 oz. of silver, and 8,445 oz. of gold.

▶ The Spud Valley mine, at Zeballos, has been purchased by a Seattle syndicate for $800,000, of which $450,000 has already been paid in cash. A public company is being formed to operate the property. P. W. Racey is engineer in charge.

▶ Monashee Development Company, a new organization, has resumed the development of the Monashee mine, 47 miles southeast of Vernon. A. H. Upton is superintendent.

▶ Fairview Amalgamated Gold Mines has completed an agreement with Mountain Copper Company, a British company which has been operating for 30 years in California, whereby the latter will finance operations at the Fairview mine, near Oliver, B. C. G. J. Vaux, managing director of Fairview, announces that Mountain Copper will spend $30,000 within six months, and if warranted by initial results, will expend $310,000 on the development of the property and the installation of a 300-ton mill.

▶ Camp McKinney, in the Boundary district, which has lain dormant for 40 years, will be revived this spring when Pioneer Gold Mines undertakes the further development of the Cariboo Amelia mine.

▶ A new company, St. Eugene Mining Corporation, Ltd., has been formed to acquire and operate the old St. Eugene mine near Moyie, B. C. The enterprise is being financed to the extent of $200,000 by Ventures, Ltd., Sudbury Basin Ltd., and Sherritt Gordon Mines Ltd.

MEXICO

Activity in Hidalgo State Increases

Several mining companies add men to their pay rolls—El Potosi and workers agree on labor contract—Mining companies and cooperatives complain of poor railroad service

▶ Mexican mining in mid-spring, though generally slow, was marked by some exploitation and expansions, particularly in Hidalgo. The government-sponsored mining cooperative system showed signs of difficulties. Representatives of these societies told the Government that if it did not promptly assist these miners financially, in the form of rebating mining taxes they pay, excepting the 12 per cent impost on exports, as was ar-

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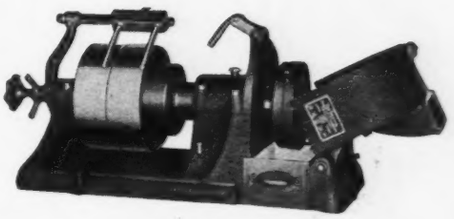

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▸MEXICO

ranged last September, these 20,000 workers are threatened with unemployment.

▶ Labor peace was made by El Potosi Mining, Santa Eulalia, Chihuahua, with a new contract that increases salaries of miners and surface workers by 75 centavos (about 15c.) a day.

▶ Some mining companies have complained to the Government that faulty railroad delivery of oil and other combustibles is slowing down their operations. Cooperative societies have complained that irregular deliveries force work suspension for several days at a time in two important mines.

▶ Engineers of a Mexican mining syndicate are examining two important Sonora gold properties, La Dura and Golfo de Oro, in the Yaqui district, with a view to resuming operations.

▶ The Magdalena mine, Temascaltepec, State of Mexico, is being made ready for intensive operations by Lane Rincon Mines, H. C. Enos, general manager, which recently assumed charge of the property on a bond-lease arrangement.

▶ The San Juan mine, an important gold-silver producer at Chalchihuites, Zacatecas, is being operated by its employees on a cooperative basis, under an arrangement approved by the Federal Labor Department. For the first time in modern Mexico, the cooperative began work with the formal blessing of the parish priest.

▶ Three bandits were killed in an unsuccessful attempt to raid properties of the Cia. Minera Olga, S. A., at Compostela, Nayarit. The raiders were beaten off after a gun fight with Domingo Rodriguez, manager of the properties, and eight miners, all of whom were wounded but recovered.

▶ A marked increase in mining activity in Hidalgo, work that has resulted in the employment of about 400 more men, is announced by the Ministry of National Economy. Most of this new work is being done by the Cias, Minas Santa Ana y Anexas, San Jose, Santa Teresa, La Reina y Anexas, Beneficiadoras de Pachuca, La Union, Explotadora de Hidalgo and Metalurgica de Atotonilco and the Neg. Minera del Espiritu Santo y San Zenon.

▶ Modernization and improvement to two treatment plants and doubling the capacity of the mill are being arranged by the cooperative society that recently assumed charge of properties of the Cia. Minera Santa Fe de Guanajuato, Guanajuato.

▶ Monthly shipments of 50 tons of gold ore are being made by the Cia. Minera Heriberto, S. A., owned by a Chinese syndicate, from its mines some seven kilometers from Los Angeles Bay, Lower California, to El Paso, Tex., for treatment.

▶ Difficulties that beset operation of properties at Guanajuato City of the Guanajuato Reduction & Mines as a result of friction between prospectors who sought to intrude upon the workers' cooperative society have been eliminated by the Federal Labor Department bringing about an equitable arrangement for this work. The prospectors have agreed to allow the cooperative to do most of the work.

BOLIVIA

New Government Expected To Encourage Mining

Prosperity of country depends principally on production of mineral resources—Cia. Minera de Colquiri operating new mill

▶ On April 24 Lieut. Col. German Busch, of La Paz, President of Bolivia, assumed full control of the government and stated: "The country needs order, work, and morale to fulfil its destiny." He also stated that "Bolivia has no place for extreme tendencies," and gave assurances for investors of capital. Cable reports from La Paz late in April indicated mining was proceeding on a normal basis. Since tin mining comprises over 90 per cent of the country's exports, observers believe no steps will be taken adversely to effect the industry, but that measures will encourage capital to develop Bolivia's natural resources.

After the Chaco war Bolivia requisitioned part of the exchange resulting from tin exports at a rate less than in the open market, and this practice reduced profits of tin mining companies and has been a source of constant domestic difficulty. The Department of Commerce reports that United States direct interests in Bolivia at the end of 1936 were estimated at $18,337,000, principally in mining properties, public utilities, transportation, and manufacturing. There is reported to be a 30 per cent American stock participation in the Patiño group of mines. Other American interests consist of a cotton mill and cement plant. International air connections are provided by an American and a German company. The leading railway is British controlled. British capital is also involved in mining enterprises.

▶ Compania Minera de Colquiri recently completed construction of a modern 350-ton mill for recovery of tin. Considering the isolation of the mine, construction is said to have been rapid. Power is generated by the company's plant 12 miles from the mill at Rea Rea. R. Beard, metallurgist, and J. Beatty designed the plant. George MacRae is construction superintendent and O. D. Niedeimeyer is general manager. Val de Camp, of Oruro, Bolivia, is managing director of the company.

▶ Cia. Minera de Oruro, at Machacamarca, Bolivia, recently completed the addition of the flotation plant, increasing capacity from 100 to 225 tons per day. The ore is complex and requires flotation, calcination, lixiviation, and leaching in recovering silver and tin. Half of the production is from old dumps averaging 10 grams silver and 3 per cent tin. Peter Backles is general manager and K. Romberg, mill superintendent. About 700 men are employed.

AFRICA

Some New Records Made On Witwatersrand

Outlook gives promise of continued rise in gold production—Unsettled conditions defer mine financing of properties on Western Rand—Pilot plant at Nchanga nears completion

▶ Of the first 31 Witwatersrand gold mining companies to report their March production and earnings, eleven had set up new high records of monthly profits. The advantages making this possible were a long month, a full supply of native labor, and an average price of 148s. per ounce for gold. Included among those establishing new records of profits was Simmer and Jack, which is one of the oldest producers of the Witwatersrand. The profit of Daggafontein was up over £11,000 and of West Springs by £1,000. The outlook favors a further considerable increase in the Witwatersrand production this year.

▶ Unsettled political conditions in Europe are causing new financing of mining enterprises in Africa to be deferred temporarily, but it is hoped sentiment will be permitted to become more confident, so that funds will soon be provided for shaft sinking on some of the Western Witwatersrand properties in which values have been proved by drilling.

▶ Excellent progress is being made with the development of Nchanga Consolidated's property. The workings from which they were driven out by flooding several years ago have now been completely unwatered and the sinking of the haulage and pump inclines and the vertical shaft is going ahead rapidly. The erection of the pilot plant is nearing completion and tests of the ore will begin in early summer.

▶ Rhodesia Broken Hill Development Company produced 1,050 tons of zinc and 54 tons of fused vanadium in March (both long tons).

▶ New Kleinfontein Company (formerly Kleinfontein Estates and Gold Mining Company) reports a profit of £350,879 for 1938. This comparing with £312,390 in 1937, which was its previous high record. Dividends total 21¼ per cent, against 20 per cent. Ore reserves were increased by 200,979 tons to 2,978,521 tons averaging 4.85 dwt. over a stoping width of 53.77 in., the grade being up 0.06 dwt.

▶ Gold Coast developments continued generally favorable during March and profits of the producing companies were near high records or above. Ashanti Goldfields earned £107,128 after royalties, export tax and depreciation. Its best development was 25.2 dwt. over a width of 11 ft. in the Cote d'Or reef. Marlu's profit was £50,902 from the treatment of 56,160 tons of ore, working expenses being only £15,695. Ariston's profit was £24,704, and Bibiani's £11,078. Roan Antelope Copper Mines and also

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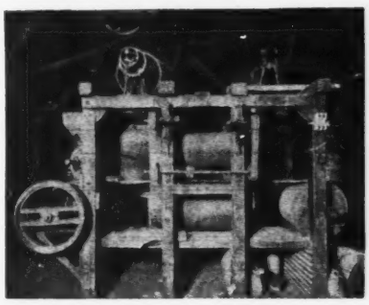

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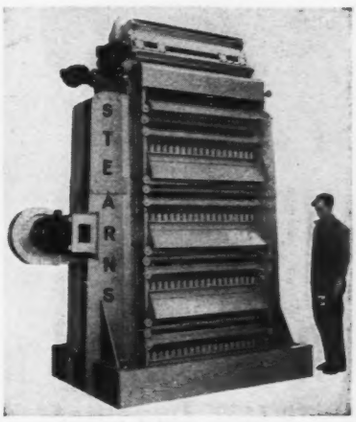

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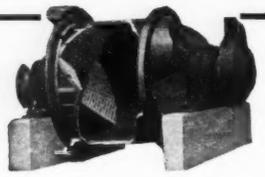

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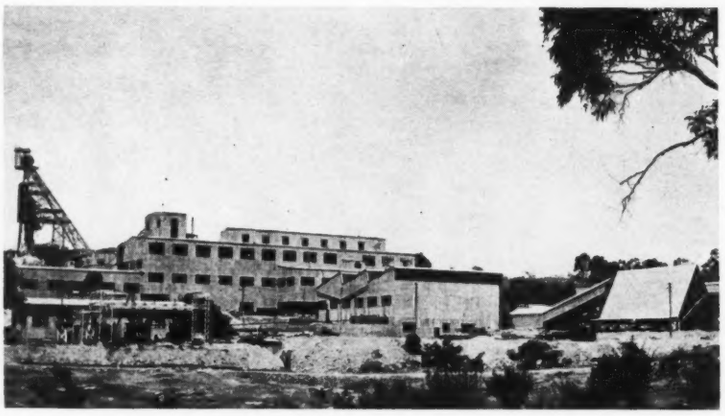
▶AFRICA

Rhokana Corporation are paying interim dividends at the same rate as a year ago. Though curtailing production in accordance with the "outside America" arrangement, the Rhodesian companies are operating profitably enough on the prevailing price of copper to maintain their dividend payments. They are extending mine developments and adding gradually to plant capacity in expectation of a greatly increased demand for copper if Europan political conditions again become settled.

▶Vlakfontein Gold Mining Company, having exhausted its working capital while still in the development stage, has arranged to borrow up to £500,000 at 5 per cent. The money is to be supplied by its three largest stockholders, Lace Propriety Mines, Anglo American Corporation, and New Consolidated Goldfields. These companies will have preferred right to subscribe for 25 per cent of 1,250,000 shares to be issued later by Vlakfontein.



New lead-zinc flotation plant of Lake George Mines, Ltd., Captain's Flat, New South Wales, Australia. The capacity is now 500 tons but will later be enlarged to 1,000 tons daily. Both lead and zinc concentrates will be shipped overseas

AUSTRALIA

Higher Capacity Planned For Several Mills

Properties in Western Australia to increase production—New gold dredge begins operation in Victoria—Tin discovery made in New South Wales

▶Lake View & Star, Ltd., Kalgoorlie, Western Australia, has put in another ball mill, and from now on is expected to treat 55,000 short tons monthly, and later anticipates raising the monthly tonnage to 60,000.

▶The new mill to be erected by North Kalgurli (1912) Ltd., Kalgoorlie, will be on the Croesus leases, which lie at the northern end of the North Kalgurli property, and which contain substantial tonnages of 6-dwt. ore. Capacity is expected to be 7,500 long tons monthly. It is assumed that operation of this mill will not for the present affect the present treatment operations of the company, which puts 11,000 tons monthly through the mill of Kalgurli Ore Treatment Company, jointly owned by it and by Boulder Perseverance, Ltd.

▶Another Kalgoorlie company to announce plans for mill extension is Gold Mines of Kalgoorlie, Ltd., which intends to raise capacity from 8,000 to 12,000 long tons monthly to enable the treatment of a large tonnage of ore, in part oxidized, which though below the average of present mill heads (which is about 7.5 dwt.), can nevertheless be treated profitably at present gold price. The mill employs the precyanidation plus flotation process.

▶Outlook of Great Boulder Proprietary Gold Mines, Ltd., Kalgoorlie, has improved greatly over the past few years. Although in 1929 the end of the mine was believed to be in sight, a vigorous development policy, initiated in 1934 under the stimulus of the higher gold price, has in the intervening period opened up reserves in excess of 1,000,000 short tons, or three years' milling requirements at present rate of treatment.

▶Paringa Mining & Exploration Company Ltd., Kalgoorlie, has bought the leases of North Kalgurli Central Gold N.L. This company also acquired within recent months the Paringa Extended and Block 45 leases, making the total area of its property 99 acres.

▶The dredge of Redbank Dredging, N.L., Redbank, the latest of Victoria's alluvial fleet, went into operation the third week of March. The dredge has a capacity of 25,000 cu.yd. weekly, and is designed to dig to a depth of 35 ft., with provision for modification to enable it to dig to 80 ft. later. It is Australian built and of all-steel construction, and is electrically driven, with 8-cu.ft. buckets.

▶Harrietville (Tronoh), Ltd., has been formed to place a large dredge on the

Harrietville alluvial area, bored last year for Tronoh Finance, Ltd., of London. The dredge will be of 350,000-cu. yd. monthly capacity, will have 18-cu.ft. buckets, and will be capable of digging to a depth of 120 ft.

▶ The old Oswald's gold mine, at Maldon, which yielded 252,000 oz. over a period of 68 years from 1858 to 1926, is being reopened by a syndicate, which plans to test the ground at the upper levels for ore recurrences which study by the State Mines Department has indicated as possible.

New South Wales

▶ North Broken Hill, Ltd., in diamond drilling at the Blackwood section of the British mine, has discovered evidence of appreciable payable ore remaining in the footwall of the old depleted stopes in this section.

▶ A discovery of alluvial tin is reported from Kikoira, about 40 miles from West Wyalong, 250 miles west from Sydney. L. J. Jones, Government Geologist, advises that although sufficient work has not yet been done to fully outline the prospect, the discovery is an important one, the existence of an extensive lead with appreciable tin values being indicated.

Queensland

▶ The scheme of operation at Mount Morgan, where the smelting and converting plant is now in operation, consists of the treatment of two grades of concentrate, one a high-grade material containing about 25 per cent copper and 4 oz. gold per ton, which is smelted direct in a reverberatory furnace, and the other a pyritic concentrate assaying 5 per cent copper, 38 per cent sulphur, and 1 oz. gold per ton, which is roasted in Edwards furnaces before being smelted. The reverberatory is 15 ft. 6 in. wide and 38 ft. 6 in. long in the smelting chamber, and is fired by pulverized coal. The arch is of silica brick, side walls are faced with magnesite brick and backed by chrome bricks, and the monolithic hearth is of fused silica.

▶ Tableland Tin Dredging's No. 1 dredge at Mount Garnet is now running well, digging to the bottom and cleaning up effectively in spite of the wash being somewhat "tight." Arrangements to convert the dredge to all-electric drive are in hand, after which it is expected to treat 80,000 cu.yd. monthly without difficulty.

Copper Refinery May Be Built Near London

▶ It is reported that arrangements are being made to finance and erect a copper refinery in England, somewhere in the London area, to treat scrap material which hitherto has been going to Germany. The plant will have an output capacity of 20,000 to 25,000 tons annually, and the latest German methods of fire refining will be employed. Later on electrolytic refining may be added. A technical expert named Goldmann, and a commercial man named Baer, from the Wilhelmsburg refinery, will, it is reported, direct and run the undertaking.

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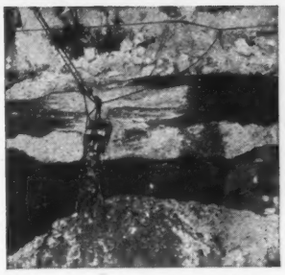

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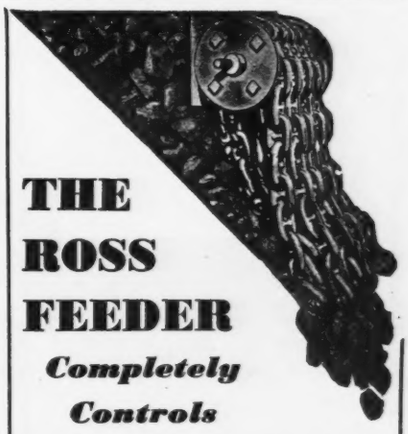

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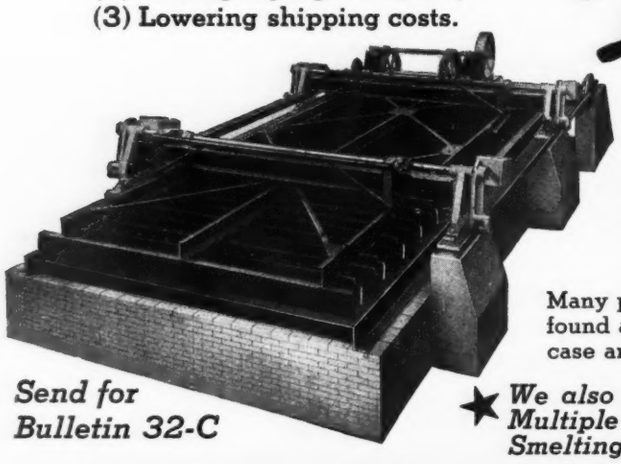

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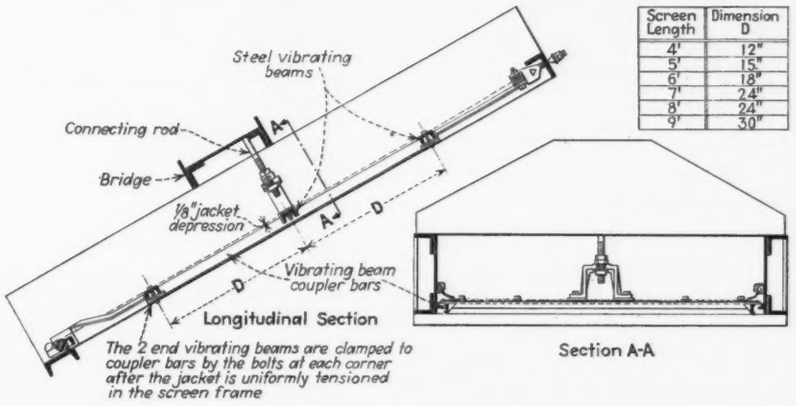
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Section A-A

Screen Length	Dimension D
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5'	15"
6'	18"
7'	24"
8'	24"
9'	30"

An EXCLUSIVE and novel feature of Leahy Heavy Duty NO-Blind Vibrating Screens is the Tri-Vibe Panel, announced by the Deister Concentrator Company, Fort Wayne, Ind. Where formerly the free-swinging screen jacket was powered from the vibrator by one vibrating beam, the new Tri-Vibe Panel triple powers every square inch of screen jacket with the direct energy of dynamic Leahy differential vibration. The Tri-Vibe Panel is made up of three vibrating beams, suitably tied together by coupler bars along the sides. Thus the positive vibration set up by the Leahy vibrator is regenerated in the screen jacket by triple delivery under controlled transmission and distribution. Full surface vibration is said to be readily assured by the new construction, which also permits an easier adjustment of screen jacket tensioning, a more positive vibration over the full screen jacket, and increased life of screen cloth.

Primer for Rubber Coatings

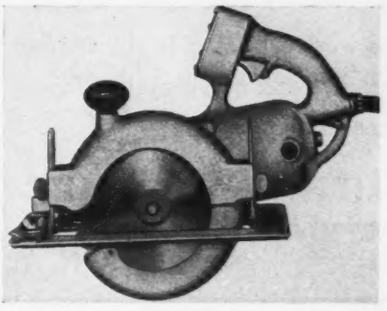
A NEW, SINGLE-COAT liquid-rubber primer coating material has just been developed by the Self-Vulcanizing Rubber Company, 605 W. Washington Blvd., Chicago, Ill. It is said to dry cold to a solid surface within an hour, and withstands temperatures to 212 degrees. Known as Self-Vule "M-A" Single-Coat Primer, this new product is used for bonding Airvule liquid rubber to metals, concrete, glass, tile, brick, etc. Used alone, it rust-proofs and water-proofs many kinds of surfaces. This new, fast-drying Primer is the first coat upon which the liquid rubber is applied for rubber-lining acid and pickling vats, tanks, tubs, fans, blowers, air ducts, plating racks, filter press plates, tail shafts, marine outboards and subsoil pipes. One gallon is said to cover 250 sq. ft. of surface.

Retards Fogging

INDUSTRIAL PRODUCTS COMPANY, 789 W. Somerset St., Philadelphia, Pa., announces the Ipco Fog-gle Cloth that is said to clean, polish, and retard fogging on goggles. The principle of the cloth is to prevent lenses from banking with condensation and making it possible to see what the wearer is doing or where he is going. This is accomplished by a non-toxic wetting out agent which reduces surface tension of the glass. The cloth is said to be practical in that it is always ready for use and may be carried in the goggle case.

New Electric Saw

AN ELECTRIC SAW reported to incorporate all the latest improvements in saw design and construction, was recently announced by the Syntron Company, 510 Lexington Avenue, Homer City, Pa. Known as Model 25-S Saw, it is said to have a cutting capacity of $2\frac{1}{2}$ inch material at 90 degrees and of $1\frac{3}{4}$ inch material at 45 degrees bevel—the thickness of a finished 2 x 4. It can also use a thin abrasive disc to score or slot brick, tile, marble, etc. The saw blade is totally enclosed in a telescoping safety guard that has the official approval of the most stringent state safety codes. Total weight of saw is 19 lbs.



Improved Burst-Proof Hose

A NEW AND IMPROVED Burst-Proof Steam Hose has been introduced by The B. F. Goodrich Company, Akron, Ohio, which is said to make for prolonged life in this severe service. Tube of the hose is made from an improved compound possessing still greater heat-resisting properties and its capacity to resist steam penetrating into the hose carcass and through the cover is vastly superior to previous compounds used. On sizes $1\frac{1}{4}$" and larger, one ply of strong asbestos *woven* fabric and a spiral wire reinforcement are placed between the wire braids. On hose sizes 1" and under a braided asbestos fabric is used as experience has proved that this type material offers ample strength in smaller size hose construction. The improved Goodrich Burst-Proof Steam Hose is said to be recommended for saturated steam pressures up to 200 lbs. per square inch, or super-heated steam up to 390° Fahrenheit. It is available in a range of sizes from $\frac{3}{8}$ to $2\frac{1}{2}$".

Castable Refractory

AS A RESULT of its recent development work on castable refractories, Johns-Manville, 22 East 40th St., New York, N. Y., announces a new light-weight Firecrete for making special refractory shapes, for replacing difficult brick construction, for lining furnace doors, and for making small monolithic linings. The new product is said to be suitable for working temperatures up to 2,200 deg. F. Sixty-five pounds of the mate-

A new automatic coupler design for mine and industrial applications is announced by the Ohio Brass Company, Mansfield, Ohio. Rubber buffing pads capable of absorbing impact blows up to 50,000 lb. are used in place of conventional draft spring construction

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PLAT-O HEAVY DUTY VIBRATING SCREENS for large tonnages ore, sand and gravel, crushed stone, etc. *Bulletin No. 26.*

MULTIRAP VIBRATOR—High speed for fine screening. Non-blinding, high efficiency, long life screen cloth. *Bulletin No. 24.*

COMPOUND FUNNEL CLASSIFIER—Gold trap for coarse gold. Preparation of ore pulps for table concentration. *Bulletin 23.*

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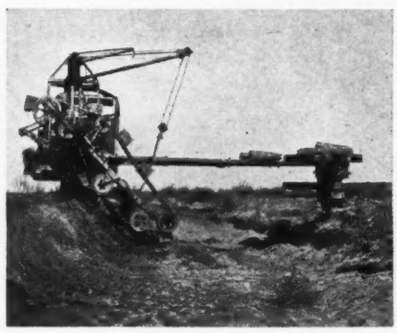
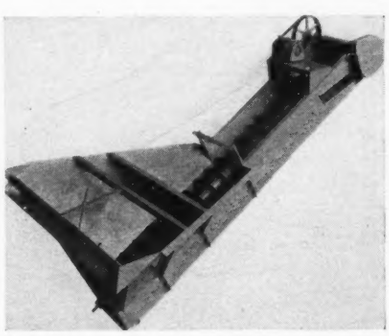
rial are required per cubic foot of finished construction. It can be used to form any required refractory shape. This is accomplished within a short period of time simply by mixing light-weight Firecrete with water and casting it into a form. Twenty-four hours later the shape is ready to be placed in service.



This excavator travels as it digs. Announced as the Bucyrus-Ruth excavator by the Bucyrus-Erie Company, South Milwaukee, Wis., the digging unit has a chain of buckets supported on a digging ladder which can be swung to either side for digging or directly to the rear for traveling from job to job

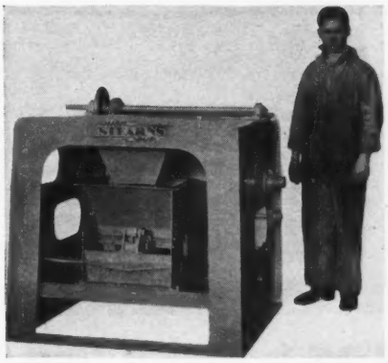
New Sand Classifier

RECOGNIZING the steadily increasing demand for closely graded sands, Smith Engineering Works, Milwaukee, Wis., announce a new sand classifier. It is said to dewater, rewash, and classify sand, operating on the same principle as the Telsmith sand drag. To secure closer gradation of fine and coarse sands, the water capacity is greatly increased and a larger screw is furnished, greater in length and with a spiral of shorter



pitch set at a considerably steeper angle. According to its designers, the new sand classifier produces a well-watered product, and handles larger water capacities. Water overflow velocity and size of finished product are regulated by a new type of quickly adjusted control. The screw, of special abrasion-resisting steel, is mounted on a shaft, having a water-lubricated, cutless rubber bearing at the lower end and combined thrust and radial Timken bearing at the upper end. All moving parts are substantially mounted in a steel box of special shape.

The new classifier is made in single and double screw types with sand capacities from 10 to 60 cu.yd. hourly.



High-duty improved and redesigned type DH magnetic separator for removing impurities from finely ground material in wet or dry operations is announced by Stearns Magnetic Manufacturing Company, Milwaukee, Wis.

New Blasting Agent

A NEW BLASTING AGENT, "Nitramon" S, for seismic prospecting by the reflection method, has just been announced by E. I. du Pont de Nemours & Company, Wilmington, Del. It is packed in metal cans with ends which permit joining of a number of separate units before loading in the blast or shot holes.

"The blasting agent is much safer to handle and use than gelatin dynamites normally used for reflection shooting," the company's announcement says. "It is not an explosive in the accepted sense, since it cannot be detonated by the strongest commercial detonators, by Cordeau or Primacord detonating fuse, by flame, or by heavy blows, which is particularly important for the safety of field crews. Even the impact of a rifle bullet will not detonate the charge.

INDUSTRIAL NOTES

Raymond J. Briggs announces his resignation as a chief engineer for the United States Government and return to his private engineering offices at 210 Noble Building, Boise, Idaho.

Greene, Tweed & Company announce the opening of their new executive offices at 101 Park Ave., New York City.

Henry W. Erickson, engineer in the Crushing, Cement and Mining Division of Allis-Chalmers Manufacturing Company, Milwaukee, has been transferred to the El Paso district office, where he will take up new duties as a representative specializing on mining machinery built by the company. **Stanley Michaelson,** engineer in the mining division of Allis-Chalmers Manufacturing Company, Milwaukee, has been transferred to the Salt Lake City district office, where he will take up new duties as sales engineer specializing in mining and related machinery.

W. W. Sly Manufacturing Company, of Cleveland, Ohio, which specializes in the manufacture of dust control equipment, recently appointed Snyder Engineering Corporation, of 2444 East 24th St., Los Angeles, Calif., as its representative.

BULLETINS

Water Softener. International Filter Co., 59 E. Van Buren St., Chicago, Ill. Bulletin 1820 gives complete information on the manufacturer's devise for water softening. Pp. 11.

Condensate Purity Instruments for the Steam Plant. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. Catalog N-95-163 describes a reliable electrical method for continuously determining variations in condensate purity. Pp. 20.

Electric Eye. United Cinephone Corp., 43-37 33rd St., Long Island City, New York, N. Y. A 9x6-in. booklet entitled "Marvels of the Electric Eye." Imparts comprehensive data on many uses of the electric eye in various industries. Pp. 11.

Drill Rig. Sullivan Machinery Co., Claremont, N. H. Bulletin 87-B describes the UW-161 Featherweight Drill Rig. Pp. 4.

Engineering Properties of Nickel. International Nickel Co., 67 Wall St., New York, N. Y. Bulletin T-15 has technical information on monel, nickel and nickel alloys. Pp. 19.

Crushers. Hadfields' Ltd., Sheffield, England. Bulletin 418 describes the manufacturer's patent stone and ore crushers. Pp. 16. Bulletin 420 describes Style B short-shaft gyratory crusher. Pp. 8.

Wood Preservative. Wood Treating Chemicals Co., 332 S. Michigan Ave., Chicago, Ill. Folder describes Wood Tox for the control of wood decay, sap stain and termites, and to retard shrinkage and swelling in wood. Pp. 4.

Panel Instruments. Roller-Smith Co., Bethlehem, Pa. Catalog 48A describes their line of 3 in. and 4 in. round and square alternating and direct current panel instruments. Pp. 8.

Repeat Sectionalizer. Electric Controller & Manufacturing Co., 2700 East 79th St., Cleveland, Ohio. Folder 1400 explains a device for the protection of direct-current sectionalized power circuits in mines. Pp. 4.

Brazing Tool Tips. Handy & Harman, 82 Fulton St., New York, N. Y. Bulletin 11 describes a process of brazing cemented carbide tool tips with a low-temperature brazing alloy having a medium silver content. Pp. 1.

Lubricating Equipment for Mines. Lincoln Engineering Co., St. Louis, Mo. Bulletin 602 illustrates lubrication filtering for service in the mining industry. Pp. 3.

Electric Locomotives. Wingrove & Rogers, Ltd., 12 Dartmouth St., London. Publication L-GA64 is a well-illustrated booklet of various types of electric locomotives for industrial uses. Pp. 28.

Valves. Allen-Sherman-Hoff Co., 225 S. 15th St., Philadelphia, Pa. Catalog 1237 describes and illustrates the manufacturer's new swing and rotary valves. Pp. 7.

Metal Buildings. Columbian Steel Tank Co., Kansas City, Mo. Catalog describes and fully illustrates construction details for warehouses, small factory, and homes made of steel. Pp. 24.

Tractors. Caterpillar Tractor Co., Peoria, Ill. Catalog for 1939 covers the entire "Caterpillar" line of the manufacturers. Pp. 31.

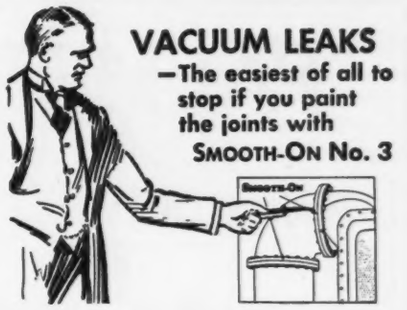
Portable Electric Tools. Van Dorn Electric Tool Co., Towson, Maryland. Catalog for 1939 covers 114 portable electric tools, such as drills, hole saws, and drill stands, as well as accessories. Pp. 57.

High-Temperature Cement. Quigley Co., 56 West 45th St., New York, N. Y. Catalog H. G. 501 describes and illustrates uses for Hytempile, a plastic, air-setting, high-temperature cement for bonding firebrick. Pp. 20.

Motor Application Chart. Louis Allis Co., Milwaukee, Wis. The chart lists 26 types of motors and specifies type of motor for about 50 industrial applications.

Safety Shoes. Lehigh Safety Shoe Co., Allentown, Pa. Booklet illustrates styles in safety shoes and boots. Pp. 7.

Motors. Sterling Electric Motors, Los Angeles, Calif. Bulletin 146 describes the manufacturer's Slo-Speed Motor. Pp. 4. Bulletin 148 describes the Sterling Pipe-Ventilated Motor. Pp. 2.



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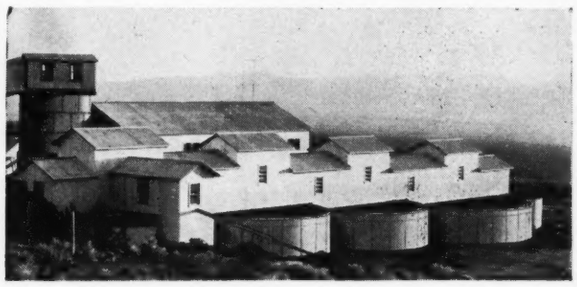

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